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POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

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GOLF in YOUR OWN BACK YARD by "Chick" Evans

See Page 492

SEE PAGE 367

Why did you pick the oil you now use?

Because of the crude it was made from? Then it may be a deficient oil!

Perhaps you picked an oil for your engine because it was made from some particular crude. But—did you know *this?* Oil scientists know that a dozen oils of widely different quality can come from the same crude!

WHAT IS A DEFICIENT OIL?

To be a full-duty lubricant an oil must contain four essential properties to meet four definite needs in lubricating your engine. These properties must be blended in exactly the correct proportion for your particular engine. They are:

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Heat Resistance—makes your oil last longer.

Oily Character—protects moving parts from wear.

Oxidation Control—prevents gumming and sticking of valves, and clogging of passages in oiling system.

If any of these properties are lacking in an oil—or present in incorrect proportions, that oil is a deficient oil.

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Deaf-Dumb-Blind

Yet "He" STOPS Auto Thieves

What in the world IS this uncanny new discovery that so instantly terrifies auto thieves? Thieves fear it worse than poison. Its terrible power literally "petrifies" them. They cannot even remove a thing. Now your car can be absolutely safe, anywhere you leave it. Don't confuse this queer new invention with anything you ever saw. It is not a bell. Not a lock. Not an explosion. Not an electrical shocker. Not a poison gas. Yet the deadly fear it puts into thieves throws them into a panic. It works automatically the instant anyone even touches your car. Cannot injure innocent persons. Recommended by police and insurance companies. No bigger than your hand. Costs only one penny a year to operate. Almost never wears out. The cheapest, surest theft insurance you can buy. And that's not all. Excites and amuses everybody. Have lots of fun with your friends.

Mysterious New Invention Offers Agents Up To $40 a Day

So startling, so absolutely new, so peculiar is this strange discovery that agents who have already taken it on are smashing daily profit records. The greatest crowd gatherer you ever saw. The minute you demonstrate this clever invention people are bewildered. They want to know how it "stiffens," "hypnotizes," "shell shocks" thieves. The need for this scientific protection is so great—the big profit possibilities are so almost unlimited and easy—that now we will actually pay you just to demonstrate this amazing thief chaser. You don't need to sell a single one to make this money. Just stand on the street by your car and make it perform its magic wonders that set your audience agog and bring quick profits. No use wasting your time any longer with "piker" propositions. $40, $50, $75 a day is not too much to expect, is it? If we did not feel sure that you could make as much money as other men with this uncanny new discovery we certainly would not be willing to offer you pay just for demonstrating it. The protection it gives—its utter queerness—its strange power to put fear into thieves—and the fun it gives motorists make it the easiest, fastest selling, biggest money-making opportunity for you in many years.

We Pay You Just To Show It To Motorists

The market is so tremendous—orders are pouring in so fast—that we can afford to do almost unheard of things for our local distributors. Not only will we pay you just for testing it, but we will actually send you a Free Sample offer for your own car so that your car and accessories will be protected and to start you demonstrating it. Yet that's not all. We actually offer to pay you cash for merely testing it on your car. Now we have territories for 1,600 more county distributors and 100 district managers on this generous pay plan. With our nation-wide advertising plans ready to start at once, distributors should be literally flooded with orders. We have worked out a new plan so that you don't have to do any selling or demonstrating to car owners to make big money.

FREE SAMPLE OFFER

Rush the coupon for your Free Sample offer—offer to pay for demonstrating and plan that gets you big money without doing any selling or demonstrating to car owners. Send no money. Just coupon. This is not an order. Nothing will be sent C. O. D. This Sample Offer is yours free of all cost. Just mail coupon now.

Allied Industries, Inc.,
5296 Garver Bldg., Des Moines, Iowa.

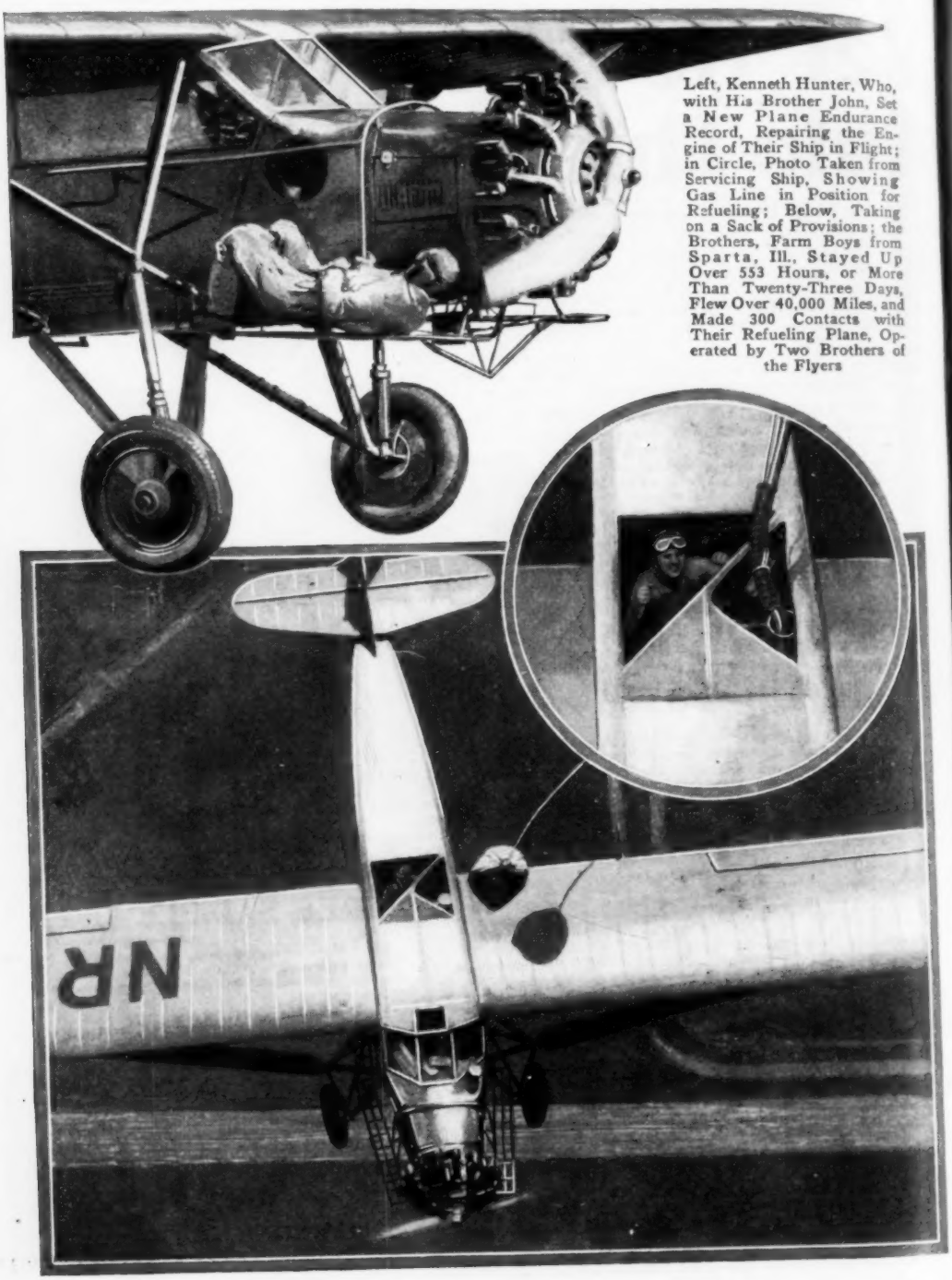
I accept your generous Free Sample offer of your amazing new thief "hypnotizer" with understanding that this offer costs me nothing now or ever. Nothing will be sent C. O. D. and I am not obliged in any way to buy anything or to become your distributor. You also offer to actually pay me for just testing it on my own car. Please send details of your offer of Pay for Demonstrating it, and also your plan that offers me big money even without demonstrating or selling to car owners. If I become your local distributer you agree to give me exclusive territory.

Name.....

Address.....

City.....State.....

SERVICING RECORD ENDURANCE PLANE IN THE AIR



Left, Kenneth Hunter, Who, with His Brother John, Set a New Plane Endurance Record, Repairing the Engine of Their Ship in Flight; in Circle, Photo Taken from Servicing Ship, Showing Gas Line in Position for Refueling; Below, Taking on a Sack of Provisions; the Brothers, Farm Boys from Sparta, Ill., Stayed Up Over 553 Hours, or More Than Twenty-Three Days, Flew Over 40,000 Miles, and Made 300 Contacts with Their Refueling Plane, Operated by Two Brothers of the Flyers

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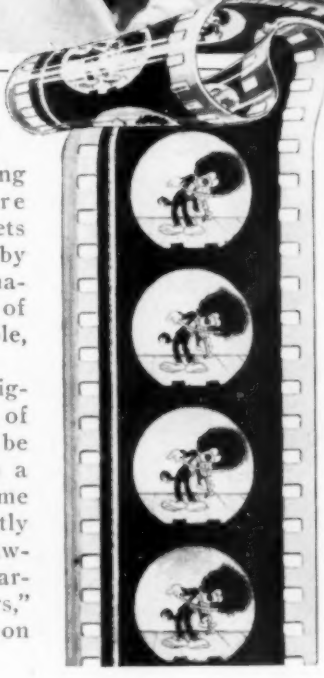
The Making of a Sound Fable

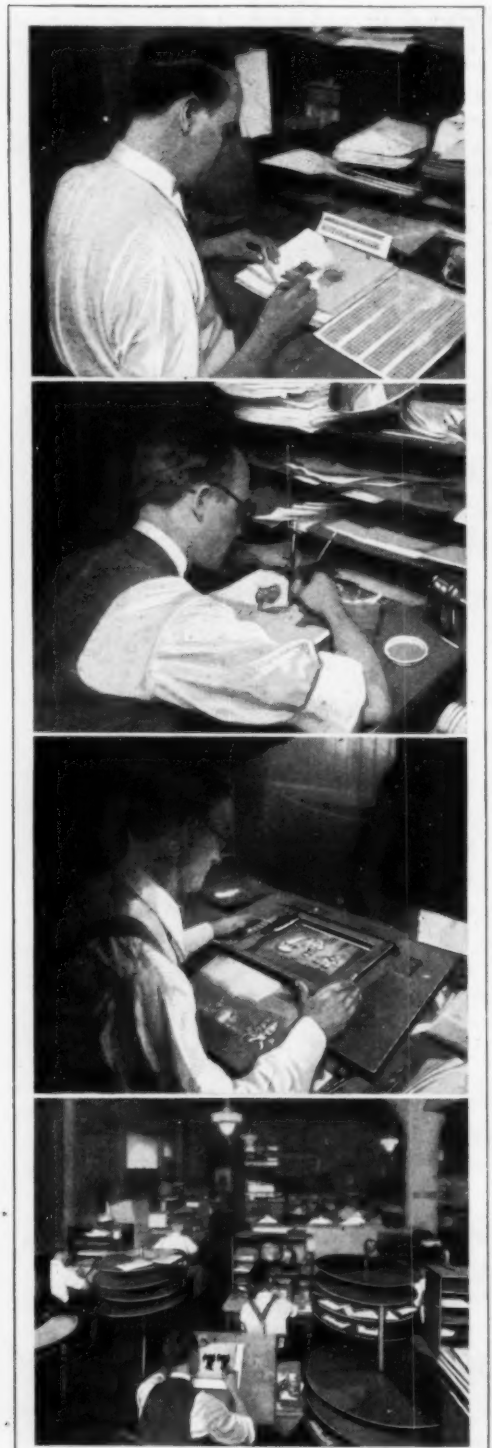


BETWEEN ten and twenty thousand penciled drawings, including no exact duplicates, are sketched on separate sheets of translucent tissue paper by a staff of fifteen artist-animators, to serve as the basis of a single Aesop's sound fable, animated talkie cartoon.

In addition to this prodigious task, every single one of those drawings must then be traced from the tissue to a sheet of celluloid of the same size, which is conveniently handled on an ordinary drawing board. Twenty-five artists, who are called "tracers," are engaged in this work on one cartoon.

These "cells" are then used by the photographers to make the movie film, which is accompanied by music from a twenty-five piece orchestra and by the numerous supplementary sounds which the "effects men" produce. The photographers make the pictures of the cells by photographing them, one at a time, with a special camera, so that, when the resulting reel is run off, there is an optical illusion of movement, because the pictures are changed so rapidly as to deceive the eye.

So, altogether, nearly one hundred experts combine their art and skill to produce one of these amusing little



Artist-Animator, Tracer and Cameraman at Work; Bottom, General View of a Fable Studio

fables. The staff is reported to be three times the number required to make a silent animated cartoon. It requires three times as much time, too, to make a sound cartoon as it does to produce a silent one.

This new sound cartoon may be compared to the ancient puppet play in that inanimate persons and animals occupy the stage, walking, talking, singing, laughing, sighing, eating, drinking, and in other ways sustaining interest of the audience. To see how the wheels go around in the puppet play, it is necessary to go backstage. Also, it is behind the scenes that a spectator must look to view and understand the unseen human forces which are combined to produce a modern sound cartoon.

In viewing a sound cartoon, the talkie audience sees no sign of human activity, yet back of it all is the harmonious cooperation of almost one hundred actors. It starts with an idea. This idea is someone's suggestion about a possible plot. In the studio in a New York skyscraper, fifteen artists sit at drawing boards and rapidly sketch on tissue paper. They make arms and legs and funny faces and folks and animals and barns, and all sorts of seemingly unrelated things. They are visualizing various ideas of the artist-animators and other members of the staff. For several days conferences are held every morning between the artists and the musical director and the "song and dance man." You see, everything must be in time with the music. The characters that dance must be given steps that are not merely a jumble of hops and jumps, and funny "gags" must be enhanced by the music.

After many thousands of penciled drawings have been completed and approved, they are handed to the tracers, who transfer them from the tissue to celluloid sheets. The completed drawings are then numbered by the supervising artist, and the number of photographic exposures to register the desired action is made.

Sixteen pictures or frames are made per second by the ordinary motion-picture camera, but the cameras that are used in photographing sound cartoons are so arranged that only one frame or picture is taken with each turn of the camera crank. The cameras are so designed that the operator merely pushes a pedal to turn the handle which brings about an exposure.

Courtesy Van Beuren Corp.

Effect Men for a Sound Fable; Note Different Articles Used for Sound Effects, and Also, Rear Center, the Sound-Proof Recording Room with Sound Engineer Gazing Out Window

Between 10,000 and 20,000 sheets of celluloid are handed over to the photographers. A background is placed under the lens of the camera. The cell is fitted onto two pegs that protrude from the camera table. The camera is poised above the cameraman and is directed downward to the pictures on the table. A schedule of what cells should be put together to make a completed picture hangs in front of him.

Suppose the scene shows Henry Cat emulating Robin Hood shooting an arrow into the air. Sherwood forest is pictured on the "setting sheet" or painted background. This drawing is placed under a frame directly beneath the camera, which is focused from overhead. A cell, bearing a drawing of Henry standing is superimposed over the background. This shows Henry in a natural position for archery excepting that the arms, bow and arrow are missing. On a second or a third sheet of celluloid these members appear. The extra sheet or sheets being placed atop the background and the first cell, the complete picture is photographed. To show the cat shooting the arrow, the arms are made to draw back the arrow on the string by substituting various sheets that contain drawings of the arms and bow and arrow in stages of progressive movement.

The next step is to synchronize the picture. The scene shifts to a sound studio. Here, in front of a motion-picture screen, is seated an orchestra of twenty-five musicians. These men have their backs to the screen and face their director. A few feet from the orchestra is a long table upon which there are scores of all sorts of odd instruments and gadgets. These things are to be used by the three effects men who are behind the table.

At a signal, the lights of the studio are turned out. The animated cartoon is flashed upon the screen. As the main title appears, the conductor waves his baton and starts to lead his musicians through the picture, keeping perfect time with the action, antics and dances of the cartoon characters exactly as he planned to do when the picture was first discussed in conferences. The effects men watch alertly for those spots in the film where effects are needed.

Five times the orchestra and the effects men rehearse with a complete showing of the film. Then the final "take" is made for showing throughout the world.

Diving Bell Large Enough to Hold Three Persons; It Is to Be Used in Salvaging the Cargo of a Wrecked Ship

DIVING BELL THAT HOLDS THREE TO AID TREASURE HUNT

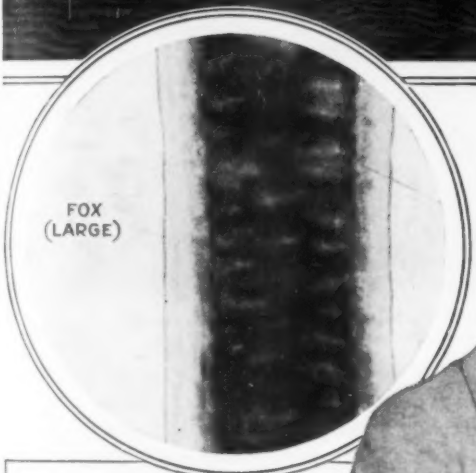
Three persons can occupy a diving bell designed by an eastern inventor for the special purpose of salvaging a shipment of copper which sank with a barge some time ago off the coast of Long Island. He expects to use it also for other hunts.

SAILING THE SKIES WITH RADIO ON AIR LINERS

To save the life of a patient who was desperately ill, a doctor of Waynoka, Okla., found it necessary to take the patient to Chicago for a very delicate operation. Accordingly, he engaged passage upon a TAT-Maddux transport plane to Kansas City, and thence by another line to Chicago. Doctor and patient took off from Waynoka at 8:45 a.m. Arriving at Wichita later in the day, they found, to their consternation, that their reservation on the other air line had been canceled. Now, if it had not been for the two-way radiophone equipment carried on all TAT-Maddux planes, this story would probably have ended there—tragically. At any rate, since there was nothing else to do, the two passengers flew on with the ship toward Kansas City. Meanwhile, one of the pilots called up the nearest ground station, telling of the plight of the doctor and his patient. The ground operator immediately stepped to the teletype and passed the word on to Kansas City. By the time the ship arrived at its destination, arrangements had been made with another line to hold a Chicago-bound ship until the doctor's arrival. Doctor and patient were rushed to the other landing field, and, making connections without delay, reached Chicago in time to save the patient's life. A pilot leaving Clovis, N. M., west-bound for Albuquerque, ran into a storm, not reported on the weather map. The sky ahead gave no promise of clearing, and there appeared to be a good chance that Albuquerque might be fog-bound. Contacting Clovis by radio, he asked the weather observer there for instructions. Teletype reports indicated that Albuquerque was indeed "steamed in." However, after a bit of calculation of wind velocities and air speeds, the observer estimated that, by the time the plane reached its destination, the fog would have blown over. This was found to be a true prediction.

Radio Apparatus on a Modern Air Liner, Showing How Messages Are Received in Air

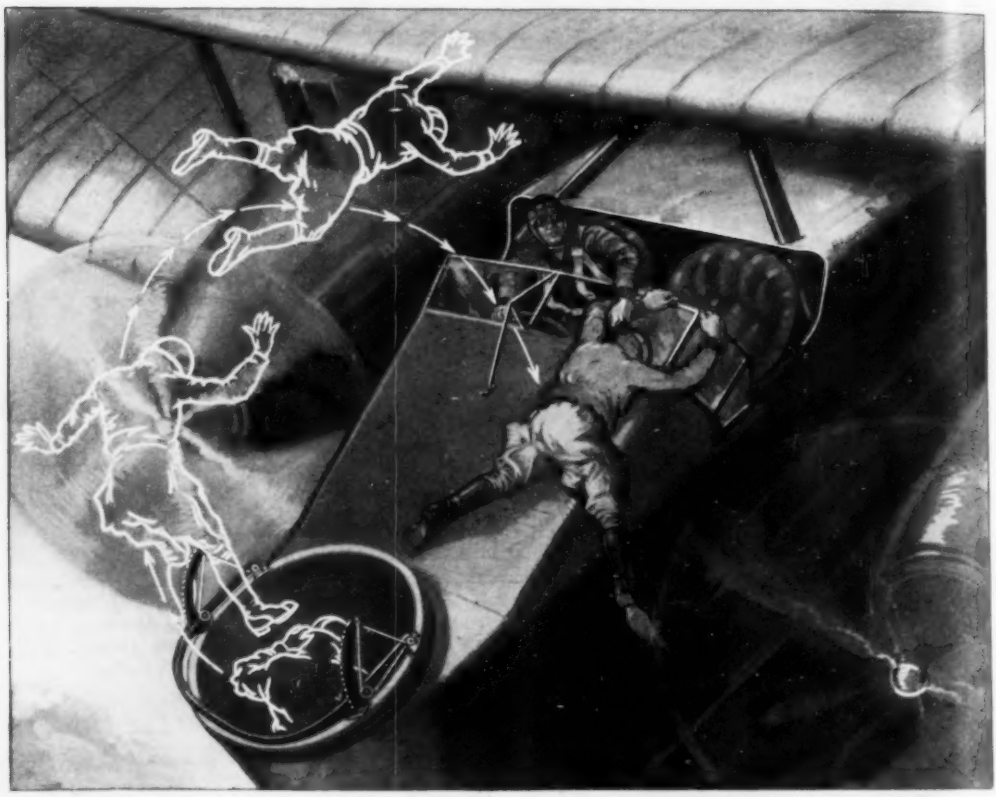
HOW HEELPRINT AND BIT OF FUR SOLVED MYSTERY



Above, Greatly Enlarged Photographs of Hairs, and, in Circle, Microphoto of White-Fox Hair, Its Pattern Identifying Its Origin and Helping to Solve a Fur-Store Robbery

The Only Clues Found after the Theft of Some White-Fox Furs from a Los Angeles Store Were a Rubber-Heel Imprint on a Bit of Glass and Some Hairs Found in a Car Seen near the Scene of the Robbery; Scientific Criminologists Found the Hairs to Be from White Foxes and Arrested Two Men Traced through the Auto; the Shoe Heel, Shown Above, of One Suspect Fitted the Heel Imprint, Left, and Both Men Were Charged with the Burglary

FLYER THROWN IN AIR IS CAUGHT ON SAME PLANE



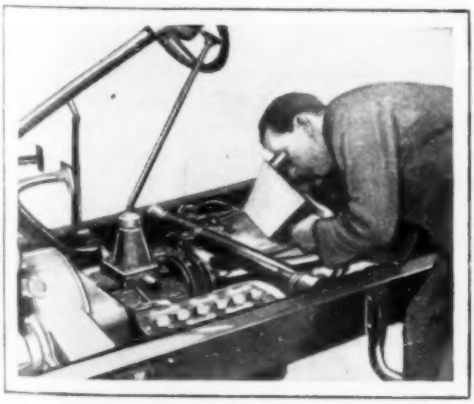
Artist's Diagram Showing How the Co-Pilot of a Big Bombing Plane Was Thrown from the Cockpit When It Struck a Down Current, Then Fell on His Ship and Was Saved from Death

Thrown from an airplane in mid-air without a parachute and caught again by the same plane is a rare experience. But this is what happened to an army aviator recently 3,000 feet above LaCrosse, Ind. A flight of big bombing planes had left an airport north of Chicago, bound for Virginia. The wind was uncomfortably cold and rough. The big planes carried two pilots who relieved each other at hourly intervals. Before his trick at the wheel, the co-pilot went forward to the gunner's compartment to put on a sweater. Just as the garment went down around his neck so he could see, the airplane encountered a sudden down current of air. It is like holding a baseball in the flat palm of the hand and quickly withdrawing the hand downward—the ball does not follow but is left suspended for a moment. When the down current struck the airplane and suddenly knocked the wings downward about ten feet, the aviator in the gunner's cockpit suddenly felt "no bottom." Next, he was looking downward at the wings of his own plane and saw a hand outstretched before his face. This was his brother pilot reaching for him. It was grab windshield, struts, edge of wing, motor cylinder, even the spinner on the hub of the propeller as a last resort. When the plane swung back up level from the terrific down current, the flyer's left foot came in contact with the side of the fuselage just in front of the co-pilot's empty seat. His hands managed to grasp a part of the windshield and he immediately tried to swing his right foot up on the fuselage, and, in so doing, it got in the way of the propeller which was turning over 1,700 times a minute. The steel blades cut through the sole of the airman's shoe, amputating a toe, but he did not feel any pain. Slowly and with the help of the other pilot, he managed

to regain his seat. Then a landing was made to obtain medical treatment of the injured foot.

EYE TURNED INTO SLOW MOVIE BY ROTOSCOPE

By means of a device known as the "rotoscope," it is now possible to examine, study and time, in daylight, such rapidly moving parts as gears, ball and roller bearings, cams, springs and valves. When using the rotoscope, the observer's vision is "geared up" to the speed of the moving object, thus making a slow-motion camera of the eye by giving a direct view without photography, and allowing exact timing at any speed from 100 to 40,000 movements per minute. The main feature of the instrument is a rotary cylindrical shutter, capable of giving as many as 1,000 glimpses a second, these blending into a continuous impression on the retina of the eye. The speed of the shutter can be varied by rapid adjustments with a tiny gear box.



Examining Rapidly Moving Machinery with the Rotoscope Which Turns Eye into Slow Movie Camera

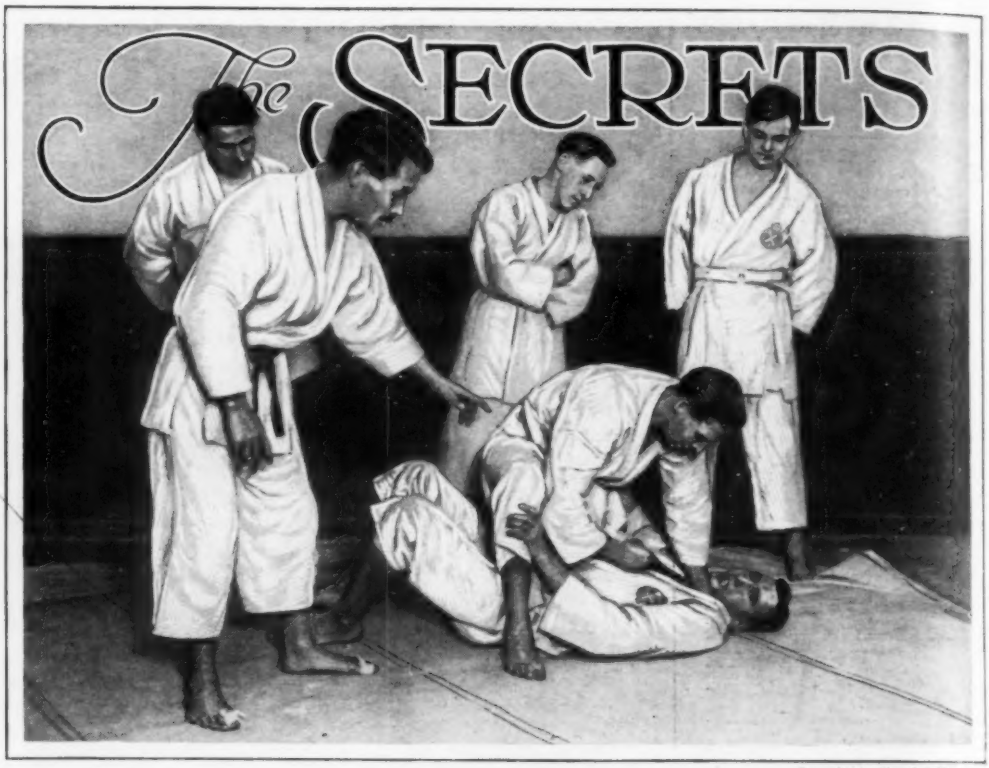
For the Enjoyment of Children This Stone Reproduction Has Been Made of the Gingerbread Palace Featured in "Hansel and Gretel"

FAIRYTALE GINGERBREAD HOUSE REPRODUCED IN STONE

Using the fairytale gingerbread palace in the second act of the opera "Hansel and Gretel" as a model, a New York manufacturer has had erected on his estate a life-size reproduction in stone of this children's wonder. The house is made of poured cement and took two years to construct. Famous fairytale characters inhabit the palace, which is topped with a roof resembling cake icing studded with hearts. It is open to children of all ages.

¶Farmers now produce as much wheat in a minute as their grandfathers did in an hour, forty-five minutes being the average time required to handle an acre of wheat with modern machinery.

The SECRETS



Copyright, Special Press

A Japanese Trainer Supervising Instruction in Jiu-Jitsu of London Policemen; London Officers Do Not Go Armed, and This Fact Makes a Knowledge of Jiu-Jitsu Most Valuable to Them

By M. K. OTORO

(Instructor in Jiu-Jitsu at Kioto University)

IF YOU KNEW how to disable a man with a slight punch from the stiffened fingers of either hand, or to knock him senseless with a light stroke of the thin side of that hand, you would consider yourself well equipped to defend yourself. If you knew how to grip a man, with one hand, so as to paralyze his arm or his leg, you would be well prepared for any attack. Yet there are twelve such blows and more than twelve such grips in the art of self-defense as developed in Japan and called jiu-jitsu.

This name means "muscle science," and the art itself involves the exertion of force to produce maximum effect with minimum effort, by directing the adversary's physical powers so that he injures himself. The master of jiu-jitsu has at his command some 250 holds, punches (more properly, "pokes") blows and tricks of falling. It is doubtful if one-tenth of these ever have been exhibited or demonstrated outside Japan. More than a score of them are known only to a very limited number of Japanese athletes, who are sworn never to reveal them. At least ten of the really deadly blows—remembering that there are twelve capable of causing death—probably never will be seen outside Japan.

One of these is a comparatively light blow, given with the side of the hand, which has been hardened by long pounding on a plank, delivered directly at the base of the nose. Another is a powerful punch with the stiffened fingers and arm (usually the right) just under the jawbone and beneath the ear. A third is a slashing blow with the side of the hand across either side or the back of the neck, as close to the skull as possible.

Knowledge of the laws of leverage, grav-

# of JIU JITSU

ity, balance and falling bodies, as well as accurate acquaintance with human anatomy, are the essentials of proficiency in jiu-jitsu. In the first position in a jiu-jitsu contest—presupposing that the fatal blows and grips are eliminated—each man grasps the sleeves of his opponent's jacket or blouse, just above the elbow. The men stand upright and, from their grips on the sleeves of their adversaries, attempt to work their hands to other and more advantageous holds.

Left, Jack Dempsey Caught off Guard by a Japanese Master of the Muscle Science, and Ready for a Fall; Below, Second Position in Applying the Arm Twist and Neck Breaker

The first and simplest trick—corresponding, if successful, to the fall in western wrestling—is obtained by a quick step forward, simultaneously throwing the right leg outward and behind the adversary's right leg. At the same time, the aggressor pulls his opponent quickly toward himself and forces him back over the right leg. Precisely at the right moment, the right hand is shifted quickly from the adversary's right arm to a point where the chest and throat meet. All the aggressor's strength is then thrown into backward pressure, and the man goes down or suffers a broken back. As soon as the adversary hits the floor, the aggressor drops with him, presses his right knee into the fallen man's stomach, holding him helpless.

One of the triple tricks involves a fall,

BLOW WITH EDGE OF HAND BELOW JAW AND EAR ON EITHER SIDE.(FATAL)
BLOW WITH EDGE OF HAND AT BASE OF NOSE. (FATAL)
WRIST GRIP AND TWIST TO BREAK ARM OR DISABLE ADVERSARY
BLOW WITH EDGE OF HAND OR STIFFENED FINGERS ON ADAM'S APPLE. (DISABLING AND OFTEN FATAL)
SHOULDER GRIP WHEREBY NERVE AND MUSCLE ARE PARALYZED
ORIGINAL SOLAR-PLEXUS BLOW, DELIVERED WITH STIFFENED FINGERS (DISABLING BUT NOT OFTEN FATAL)
ANKLE GRIP AND LEG TWIST PRODUCING PARALYZING PAIN, AND, IF CONTINUED, A BROKEN LIMB
BLOW DELIVERED WITH EDGE OF HAND ON RELAXED KNEECAP (DISABLING, SOMETIMES BONE-BREAKING BUT NOT FATAL)
PARALYZING BLOW, NOT OFTEN FATAL, DELIVERED AT JUNCTURE OF NECK AND BODY
BLOW WITH EDGE OF HAND DELIVERED AT EXACT SPOT WHERE NECK JOINS SKULL (FATAL)
POINT OF GRIP ON WRIST WHEN HAND IS PULLED OVER SHOULDER AND ARM BROKEN AT ELBOW
LEVERAGE HOLD IS TAKEN HERE TO THROW ADVERSARY OVER SHOULDER (DISABLING AND OFTEN FATAL)
BLOW WITH EDGE OF HAND AT BACKBONE JUST ABOVE HIPS. DIFFICULT TO DELIVER, BUT OFTEN PARALYZING AND SOMETIMES FATAL
BLOW BEHIND KNEE, DELIVERED WITH EITHER FOOT OR HAND, TO FELL OPPONENT IMMEDIATELY TO FLOOR
TOE AND FOOT GRIP FOR BENDING FOOT BACKWARD, PRODUCING TERRIFIC PAIN AND OFTEN PERMANENTLY CRIPPLING THE VICTIM

Showing the Various Vulnerable Positions at Which the Jiu-Jitsu Expert Aims in an Encounter; Blows at Some of These Points Are Often Fatal to the Person Attacked

a twist of the neck, which can be continued until death or permanent disability results, and the breaking of an arm. This comparatively simple trick is of the greatest value to a man when atttacked and is much used by Japanese police and detectives in subduing criminals. Grasping the assailant quickly by either arm with what children know as the "bird-claws" grip, the man attacked steps instantly toward his opponent, turning to the left, so that his back is toward the face of the man he wishes to disable. Simultaneously he throws his own right arm over the right arm of his assailant, pulls it into the common arm lock of western wrestling, and heaves the man across his back.

In this position, the man so gripped, even though his left hand is free, is powerless to halt or delay the attack, provided it has been delivered with the necessary speed. In the next movement, which comes so rapidly that the eye hardly is able to follow, the trained man hurls his assailant over his shoulder, headlong to the floor. Dropping instantly to the right side of the fallen man, the expert draws the latter's right arm across his own right leg, between the knee and hip, and presses it downward. With his left hand, placed against the fallen man's chin, he pushes the latter's neck sharply to the left, having him in a position in which the right arm may be broken with a slight, quick pressure, or the neck dislocated by putting the weight of the body on the leftward heave.

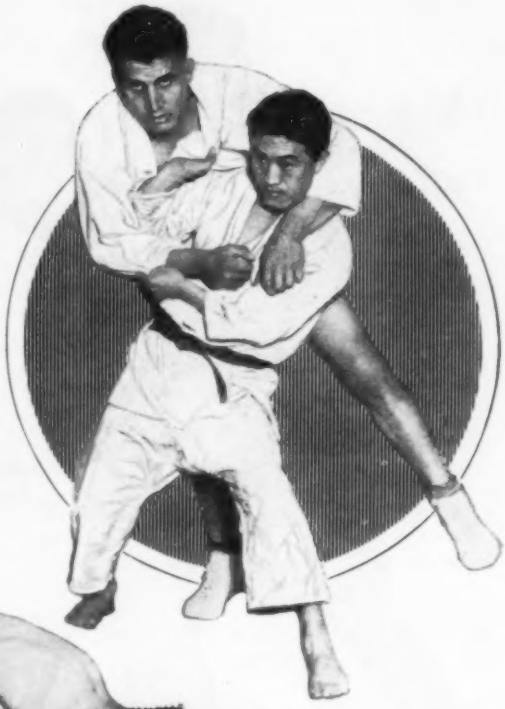
Somewhat similar to this is the neck twist from in front and the arm lift and twist from behind, accomplished simultaneously, placing the adversary in a completely helpless position while he still is on his feet. This trick—known in the western world as the handcuff—has been taught to police departments of a number of American cities and has been found invaluable in holding a man who is merely trying to escape, yet making no effort to attack or injure the officer.

The counterattack to both of these tricks is to grasp the attacker's hand with both your hands, at the very instant he shifts for his first grip, and, disregarding all his other movements, apply a sudden and powerful twist to his extended arm. Unless the attacker yields and falls to the floor, his arm will be broken. Immediately on obtaining this countergrip, the man on the defensive thrusts his right foot directly and sharply into the pit of his adversary's stomach, and, never ceasing to twist the helpless arm, pulls his opponent against that foot. Terrible pain and punishment may be inflicted by this continued pressure on the stomach and twist on the arm, after the man has fallen.

Still another method of attack is to pull your opponent toward you, release sud-

deny your grip on his sleeves, and bend forward until your right arm, well up toward the shoulder, is between his legs. Then gripping his right leg, heave him to your shoulders, whence he can be thrown to the floor with sufficient force to knock the breath from his body, stun him or even kill him. As he goes down, the attacker follows him, thrusts a knee into his stomach, shoves his head over with the right hand, palm open, and twists the right arm with his left. Even though only slightly injured by the fall, your opponent is then powerless to move.

The solar-plexus poke is the only movement in jiu-jitsu which bears any resemblance to boxing. In this disabling trick, the grips with the hands on the sleeves of the jackets are taken as usual. Then the attacker suddenly releases the hold of his right hand and throws his right arm in a circle around the left arm and hand of his adversary, trying to release the latter's grip on the attacker's jacket. If he fails, he is completely at the mercy of almost any attack his opponent wishes to press. But if he succeeds, he suddenly drives his extended right hand, with rigid fingers, into the solar plexus of his adversary. If this blow is delivered properly, and the hand twisted accurately as it is plunged into the body, the man receiving it doubles instantly with pain, and is helpless as well as defenseless to any attack the deliverer of the poke may care to use.



Above, First Movement of Combination Fall in Which the Attacker Whirls and Heaves His Opponent over His Shoulder; Below, the Somersault Trick or Foot Fall

Though many of the tricks of jiu-jitsu are concerned with the neck, arms and upper part of the body, there are others which are worked on the legs, with the grips and holds on the arms and neck being brought into use later, after the opponent has been temporarily disabled. One of the elements in this sport, of course, is surprise, so much so that the man attacked never knows just what form that attack will take, whether it be blow, paralyzing grip, or equally dangerous twist. One of the best defenses against surprise, and, indeed, against all attacks, is the sudden dropping, full length, to the floor by the contestant attacked.

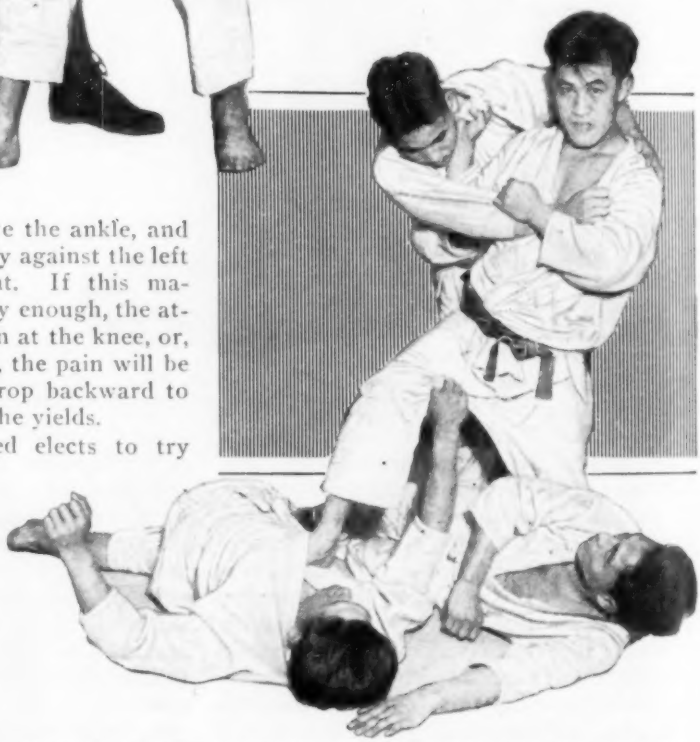
As he falls, preferably on his right side, he hooks his right foot behind the left leg

of the attacker, just above the ankle, and drives his left foot directly against the left kneecap of his opponent. If this maneuver is executed quickly enough, the attacker's leg will be broken at the knee, or, if less pressure is exerted, the pain will be so intense that he will drop backward to the floor, or cry out that he yields.

If the man so trapped elects to try to escape the foot grip by falling to the floor, the man who trapped him must leap forward, in a fraction of a second, thrust his left foot into the groin of the fallen adversary, and twist the latter's right foot until he yields. Failure to make this move with sufficient speed will result in the "trapper" finding himself "up in the air" on the foot of the man he so recently forced to the floor. This trick, I believe, never has been shown in this country, and there are only a few jiu-jitsu experts, even in Japan, who are sufficiently trained to attempt it.

Another interesting trick is known as the foot throw. When the attacker shifts his grip on the jacket, preparatory to a surprise movement, the attacked suddenly raises his left foot, thrusts it into the pit of the attacker's stomach, and falls easily backward to the floor, pulling his man with him, yet holding him aloft on the extended left foot and leg. The attacker is virtually helpless, and may be thrown end over end by a sudden heave and the simultaneous release of the grip of the attacked on his jacket.

In all the 250 tricks known to



Above, First Position in a Jiu-Jitsu Encounter; Below, Two Down and One to Go; the Expert Is Ready to Heave the Third Man on the Other Two

jiu-jitsu, we must keep in mind that the first and fundamental training of the student of this scientific sport is in the art of falling, either of his own volition or when thrown. The jiu-jitsu expert can throw himself to the floor in any direction, landing in virtually any position without harm to himself, even though the floor be unprotected by a mattress. This enables him, in many of the maneuvers, to upset the balance of his adversary, fall away from him, and literally compel the other man to throw himself.

Likewise, he can permit himself to fall, or even to be thrown, when such fall or throw is to his advantage, and to the surprise of his opponent. Indeed, the present-day science of jiu-jitsu is the accumulation of over 2,000 years of experience in the operation of the laws of physics and dynamics.

Rapid-Fire, Air-Cooled Machine Gun Mounted in Cockpit of Airplane; It Is Capable of Firing from 600 to 800 Rounds a Minute

DOZEN ROUNDS A SECOND FIRED BY NEW MACHINE GUN

Browning air-cooled machine guns, capable of firing from 600 to 800 rounds a minute, or at the rate of a dozen bullets a second, now are being used by some national-guard aviation units, the more rapid weapons being mounted in the planes in place of the old guns, which fired from 400 to 600 rounds per minute. The latest weapons are not only faster, but more accurate than the older ones, as they are equipped with compensating sights which move up and down with the wind in varying degrees of velocity, thus making the aim almost infallible. The guns are mounted in the rear cockpit of an observation plane for target practice.

BARKBEETLES SLAIN BY ACID FORCED INTO TREES

Fumigants, such as hydrocyanic acid, are being injected into pine trees to control the spread of barkbeetles and other harmful insects. Scientists say that, at the present stage of the experiments, the tree as well as the beetle is killed. They now are hopeful of finding a dosage that will kill the insects without harming the tree. In applying the acid, containers filled with the fumigant are fastened to the tree above a notch, that is cut in it, and the fumigant is taken up by the sap stream through a rubber hose.

Injecting Hydrocyanic Acid into Pine Tree; the Poison Is Used to Destroy Barkbeetles

¶Those wishing further information on articles in this magazine can obtain it from our Bureau of Information. The service is free.

Mechanical Hen, Tall as a Man, That Not Only Shows How She Lays Her Eggs But Tells about the Process

MODEL HEN TELLS AND SHOWS HOW AND WHAT SHE DOES

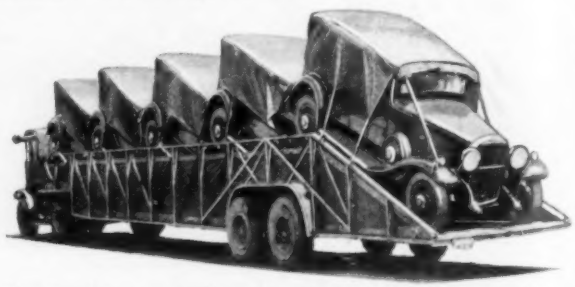
That historic cackling hen which you have heard so much about has gone "talkie" under the seasoned administrations of Uncle Sam's showmen. The government's latest masterpiece consists of a lifelike model of a hen, tall as a man, clothed in the feathers of former champion layers, which not only shows how she manufactures and lays eggs but simultaneously tells about how she accomplishes it. The arrangement is such that the spectators have a cross-section view of the internal workings of "Biddie" in action. The divisions of her heart are depicted by glass containers filled with red and blue liquids which are circulated by a pump. The cut-out figure shows corn passing to the hen's crop, whence the feed passes to the stomach where it is mixed with digestive juices. The natural processes are imitated to show how blood is formed and circulated, and how the egg and its shell are made.

DEVICE COACHES PUPILS IN TAP DANCING

Students at the University of Illinois who are taking tap dancing have their mistakes set down against them as they dance by a machine which acts as coach in recording the foot beats on paper and compares the rhythm with a steadily beating metronome. The brass taps worn by the dancers are connected with an electric recording apparatus. The paper records, showing how well the student dancer performs, are filed to show his progress.

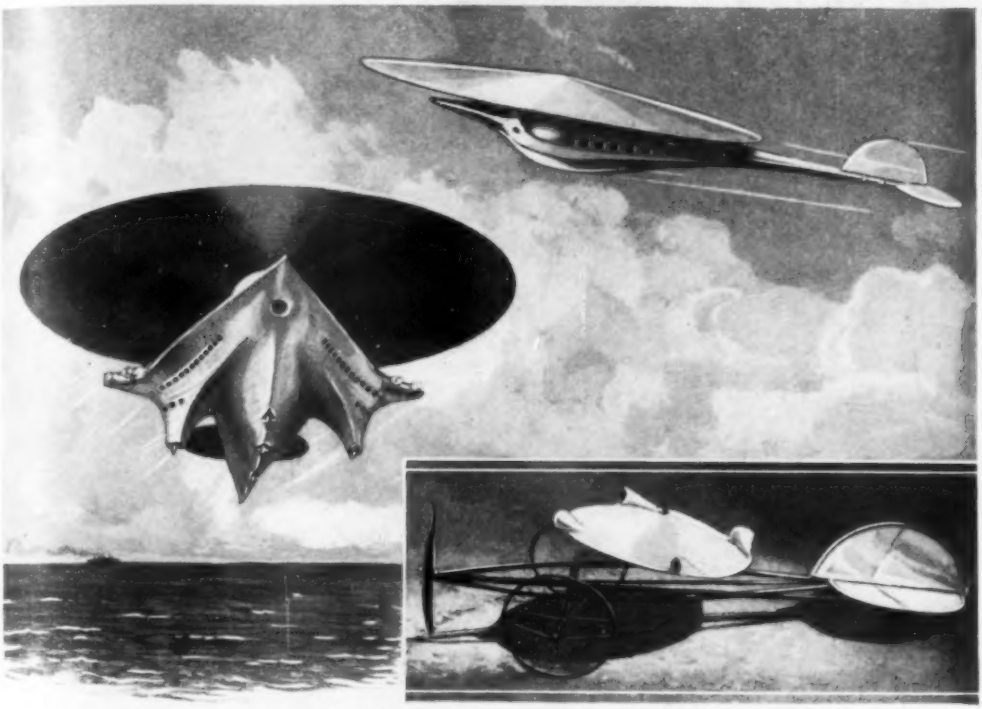
CARS LOADED AT ANGLE IN AUTO TRAILER TO SAVE SPACE

To conserve space and make possible the hauling of more cars, a truck and trailer for carrying automobiles from factory to dealer has provision for loading the cars at a sharp angle, the rear end being raised so that the hood of the car behind may be placed under it. On either side of the truck is a track in which are fitted several small coaster dollies or trucks with a framework to fit the differential housing of the cars. The car is backed to a track extension, and the dolly put in place, a hand-operated winch drawing the car onto the trailer. The carriers may be adjusted for various wheelbases, and the device provides for carrying five cars in a space that could not hold more than three in the conventional manner. Another trailer is double-decked, having room for two tiers of cars and thus accommodating ten of them.



Cars Loaded at an Angle on Frames in Auto Trailer, Thus Allowing Five Autos to Be Hauled Instead of Three

PLANE WITH ROTATING WING ACTS AS PARACHUTE



Models of a Flying Boat Equipped with a Single Disk-Shaped Rotating Wing That Is Filled with Gas or Hot Air; the Insert Shows a Small Flying Model of a Similar Craft

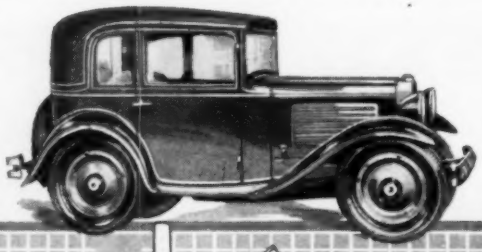
Features of an amphibian, a dirigible, a gyropter and an ordinary airplane are incorporated in a flying machine designed by Guido Fallei, originator of an aerial torpedo which was ready for production just as the World War closed. The craft has a single wing, a rotating disk-shaped affair filled with gas or hot air. It is turned by a gasoline engine as is the propeller, the machinery being located in the central part of the body, while quarters for crew and passengers are arranged on either side. The body has retractable wheels so that the ship can be landed on the ground or on water. The inventor believes that his craft will require less power for lift, that it will be stable and can be built at reasonable cost. In descents, the rotating wing is intended to act as a parachute. In the full-size craft the elevators as well as the rudder are designed to be replaced by smaller disks similar to the main wing and rotating, the former, in a horizontal and the latter in a vertical plane. Two models have been built and tried out with promising results, in one of which the main disk is rotated by means of compressed air blown out through openings at the edge, as shown in one of the photos.

"MINING" LOGS FOR SHINGLES

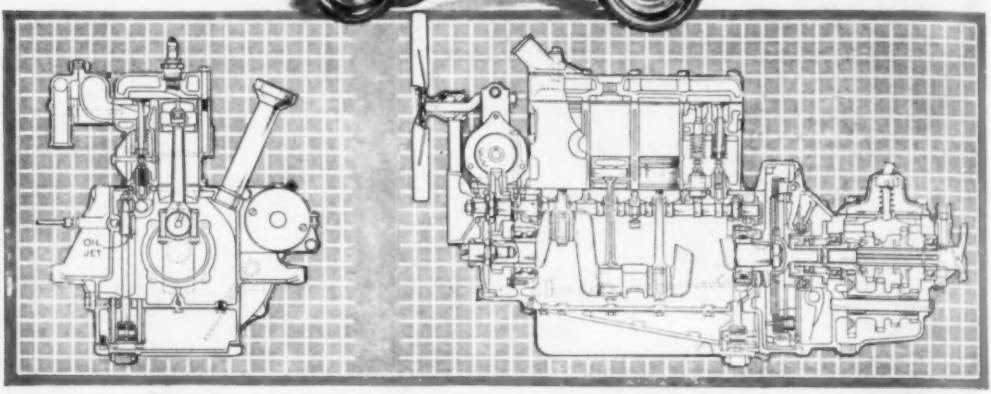
From the swamps of southern New Jersey, white-cedar logs are being "mined" to produce shingles. Shingles cut from these tough and fine-grained logs taken from the peaty swamp soil, have been found to possess better weather-resisting qualities, and many are found in perfect condition after a century of service. Independence Hall in Philadelphia is covered with shingles from these "mines." The logs are located a few feet below the surface by probing with an iron bar. The muck is then dug away and the log is sawed into shingle lengths with a handsaw under water, the lengths being split into shingles as they rise to the surface. Most of these logs have reposed in the swamps for centuries.

FIRST AMERICAN MIDGET CAR RUNS AT HIGH SPEED

The American Austin is the first European-type small car to be put into production in the United States. Alongside it the Ford is a



Its main novel features include a two-bearing crankshaft, the front bearing being a dual annular ball and the rear bearing a cylin-



The Austin Two-Passenger Coupe, and Two Views of Its Power Plant; the Squares in the Background Represent Inches, Showing, for Example, That the Cylinder Block Is Only About a Foot Long

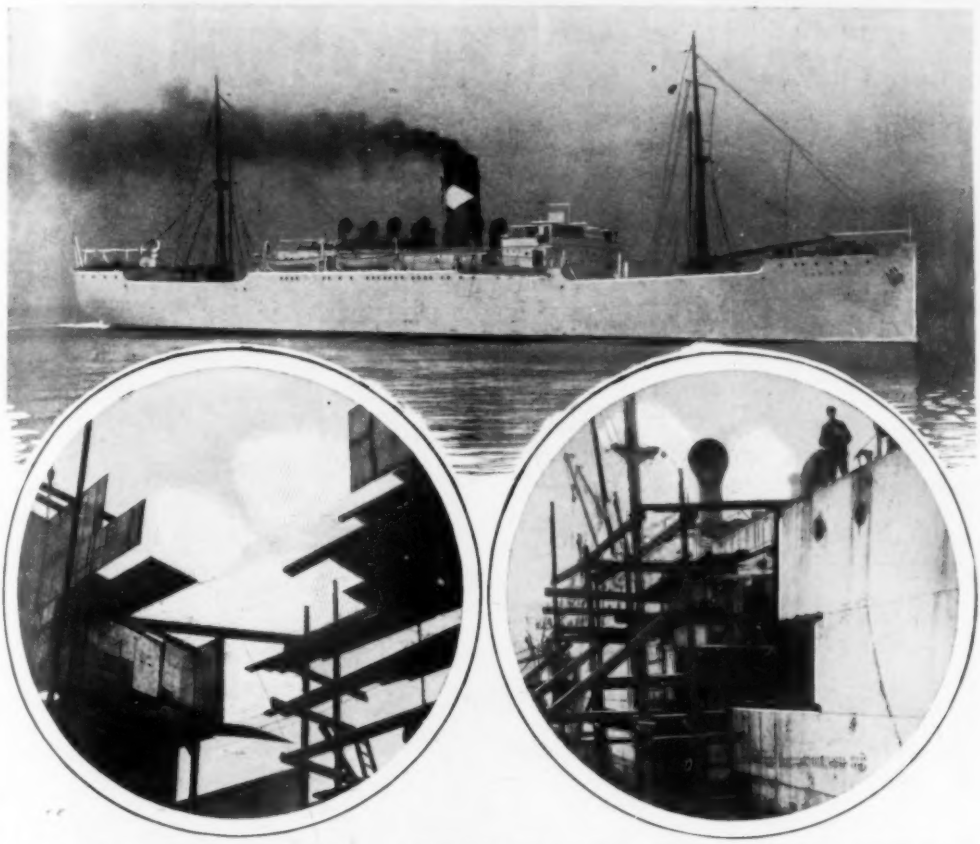
big car, since the Austin bantam has a wheelbase of only seventy-five inches, and a tiny four-cylinder engine which develops 14.8 hp. at 3,500 revolutions per minute. Its bore and stroke are 2.2 by three inches, giving a piston displacement of 45.6 cubic inches, which is less than one-fourth that of the Ford. The complete car weighs only 1,130 pounds. In consequence of its moderate dimensions it runs forty miles on a gallon of gasoline. In spite of its small size, there is ample leg room, the car rides extremely well and has a top speed of fifty miles per hour.

drical roller; a drop-forged steel flywheel; a special oiling system in which jets of oil are shot from the side of the crankcase into slots in the crankshaft, whence the oil flows to the connecting-rod bearings; a tapered frame mounted on a transverse front spring and quarter-elliptic rear springs, each spring being controlled by a special shock absorber. To keep the weight at a minimum, there is an extensive use of aluminum, including such parts as crankcase, flywheel housing, transmission housing, pistons, intake manifold, intake and discharge water connections, etc.

BABY INSECTS ABLE TO THINK EXPERIMENTS INDICATE

Can an insect think? Dr. Frank E. Lutz, of the American Museum of Natural History, has conducted a series of experiments on the larvæ of caddis flies, and these baby insects have shown an adaptiveness in their behavior that in some instances seems to contain an element of deliberate choice. The larvæ live in the water in a coccoonlike case which they make, the case being spun of silky threads and reinforced with various foreign objects. Doctor Lutz deprived a number of larvæ of their cases and placed them in vessels of water with building materials to which they were unaccustomed, the larvæ being thus suddenly confronted with a serious problem. The baby insects, however, met and solved their problem, some taking to the new materials more readily than others, but all finally building themselves new houses. Varieties that had used twigs and leaf stems, for instance, worked with sand and pebbles.

LINER IS CUT IN TWO TO FIT IN BIGGER ENGINES

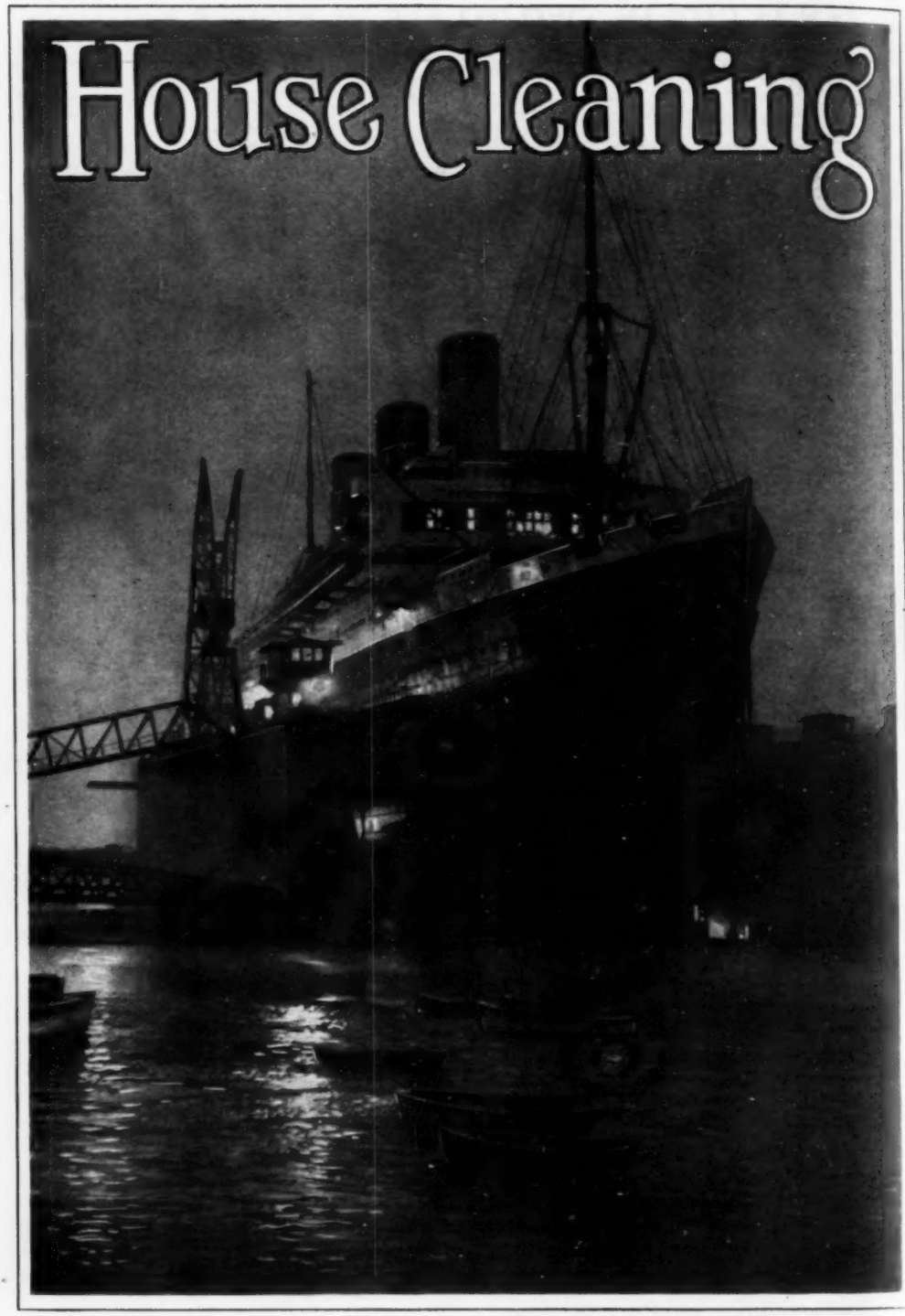


Above, Liner "Darien" After It Had Been Cut in Two and a New Section Fitted Amidships; Lower Left, the Severed Portions of the Hull; Right, Joining the Sections Together

The remarkable engineering feat of cutting in two a big fruit-carrying liner, the "Darien," taking out its Diesel engines, building in an entirely new midships portion in the wide gap and refitting it with new and more powerful turbo-electric propelling machinery so that none of the cargo-carrying space was encroached upon, recently was successfully accomplished at Belfast, Ireland. A model of the liner was first made and tests performed to find what would be the result of lengthening the ship, and what type of propeller would suit the new engines. Then the liner was towed into drydock, the rivets removed from the portions adjacent to the division on the hull amidships, and the deckhouses and superstructure cut away, together with much deck planking, pipes and coverings and machinery casing. At the end of sixteen working days, the two portions of the hull were carefully moved away from the fore and aft ends of the liner which now looked like a modern skyscraper in course of erection, girded round with steel splints and beams. Between the ends of the severed hull was now a gap of thirty feet, and extreme care had to be taken to insure that the two parts remained quite upright. As soon as these parts had settled into position, the engineers started to build in a new midships portion, just as though they were constructing a new ship, the whole job being completed in six weeks.

¶There is seventy-five per cent pure gold in eighteen-karat gold.

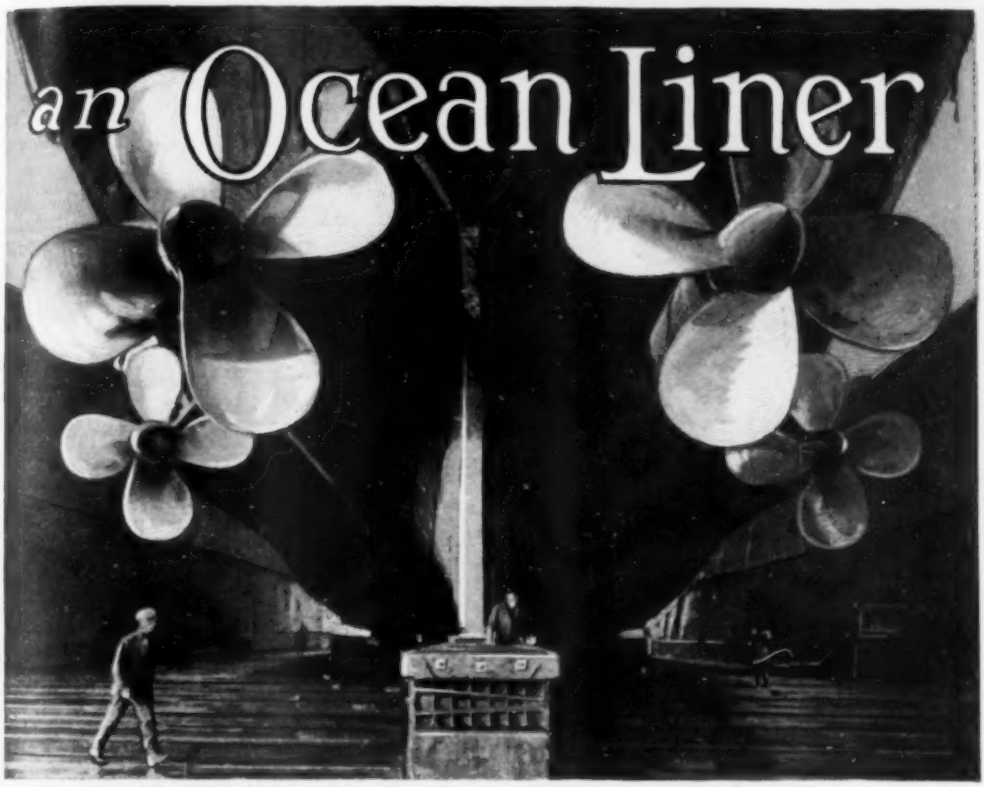
House Cleaning



Courtesy International Mercantile Marine

Night Photograph of the S. S. "Majestic" in Drydock for an Annual Spring Overhaul, Preparatory to a Busy Summer Season in the Transatlantic Service

an Ocean Liner



The "Majestic's" Propellers, like Gigantic Blossoms, Are Prominently Displayed as the Vessel Rests in the Floating Drydock at Southampton for a Cleaning

By DON GLASSMAN

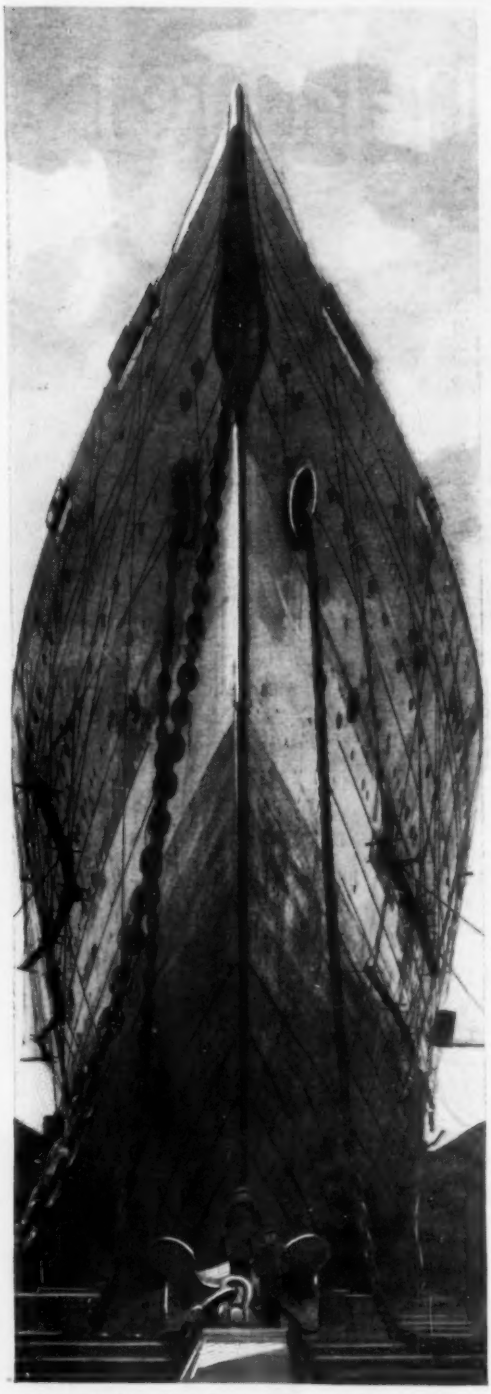
OUT of the ocean, a floating colossus is a grand sight. In drydock, a greyhound adds depth to her length. Her warehouses and engines are below the water line. Above them tower the passenger decks that reach the altitude of modest skyscrapers.

Catering to modern travelers, the business of ship operation involves much more than merely reaching a destination on time. Recently launched super-greyhounds have caused the greatest tension in shipping circles. In order to realize fair profits on their investments, steamship companies must make their ships popular. Competition is keen.

Almost any greyhound could run several years without going to drydock, for, even while afloat, a liner is never free from paint gangs and repair crews. So a trip to drydock once and, often, twice a year means that extraordinary precautions are being taken to insure the safety and comfort of ship and passengers.

The annual painting and examination of the hull, rudder and propellers require a ship to remain in dock for at least one week, and frequently more. About 1,000 men are employed to attend to the needs of a greyhound and the work is rushed day and night. Time in drydock frequently goes up to $15,000 and $20,000 per day, and if a whole fleet of passenger vessels is waiting impatiently for an overhaul in the same drydock, the cost of delays may reach a fabulous figure.

Six or seven weeks are normally required for a thorough overhaul of a 40,000-ton liner, but only a fraction of this time is spent in drydock. Estimators and engineers plan every detail of the work, so that it may proceed with dispatch and



Drydock View of the "Leviathan" Awaiting Overhaul at the South Boston Yards; Note Comparative Size of Man in the Foreground

efficiency. Thus it is possible for a ship of that size to be towed back into open water within seven to ten days after drydocking. Repairs and renovations that can be carried on while the ship floats are rarely done in drydock.

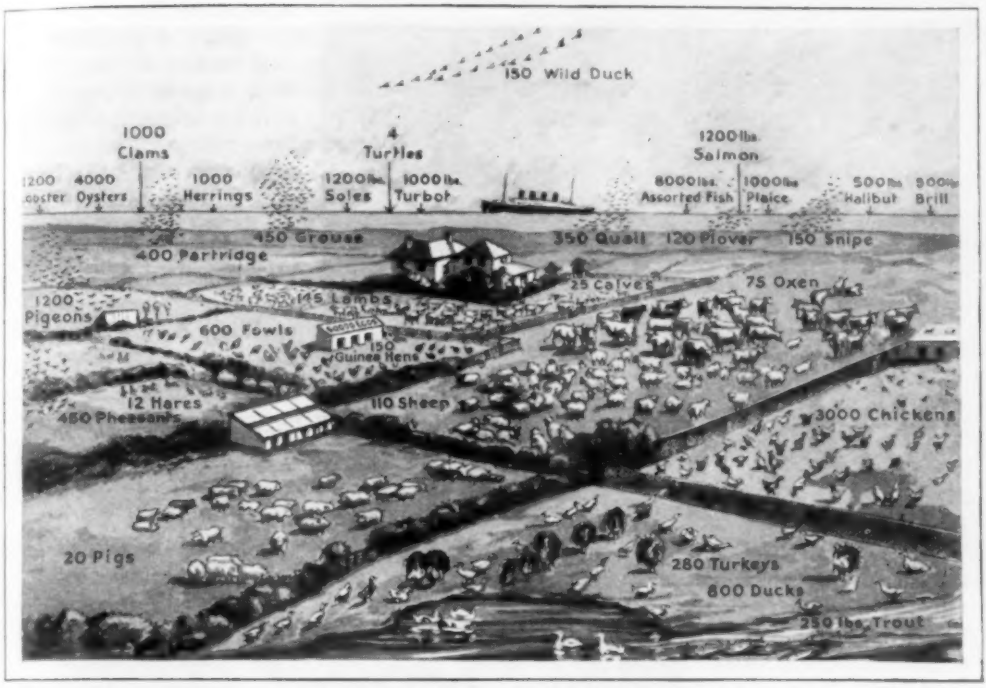
Millions are spent annually overhauling express liners. To illustrate one phase of this work on the "Majestic," the hull plates, equivalent in area to a sidewalk three feet wide and eight miles long, must be scrubbed vigorously before 12,000 pounds of paint are applied.

"The Big Three," the "Majestic," "Homeric" and "Olympic," consume three and one-half tons of putty, 6,000 gallons of paint and 120 books of gold leaf. Attendants change 2,300 pairs of curtains. Thousands of pillow slips, sheets and blankets are condemned. The exteriors are coated with six tons of enamel and fifty-four tons of paint.

The overhaul of a greyhound's linen department is a feat that must impress housewives. A great ship carries about 150,000 individual pieces, and often 100,000 of these are sent to shore laundries at one time. At these renovating plants, the turnover is so fast that every bit of a great vessel's linen can be returned within twenty-four hours. Every year there is a great sorting of good from bad. A ship is provisioned with enough extra supplies to last until the next overhaul.

Ten thousand pounds of soap vanish down the drains and scuppers as the great greyhound receives the final rub-down. Four hundred brooms pry into corners. Six hundred scrubbing, dusting and scouring brushes are worked vigorously over all surfaces suspected of harboring dirt. Is there a structure on land that receives such thorough sterilization? From keel to masthead, the renovators climb and cling. One brushes, another sweeps, another polishes, and still another scrapes.

When a greyhound docks for overhaul, the first operation of the machinists is to remove the engine heads. Then the pistons, piston rings and other wearing parts. The high-power, intermediate-power and low-power cylinder covers are removed and all pistons opened for inspection. A small auxiliary—the "turning engine"—at the base of the great driving engines



Picture Diagram to Show the Huge Quantities of Live Stock and Other Provisions Required for the Stores of the "Aquitania" on a Single Voyage

adjusts each piston to the bottom stroke, where it can be inspected. Then the main-engine valve covers are removed and valves drawn for examination. If found satisfactory, they are returned at once and reset. But if defective, the only cure is replacement.

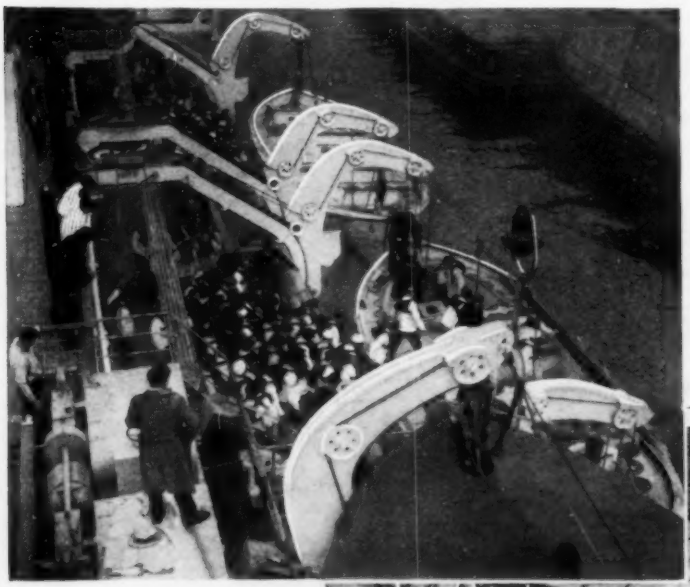
During an overhaul, many liners pass through structural changes. Partitions are removed, either to enlarge staterooms or to add commodious bathrooms. Or a second-class dining room may be converted into an auditorium or talking-picture theater, which will soon be standard equipment on all passenger ships. When it comes to styles of interior decoration, ship operators do not allow their pets to lag. If ivory finish is the vogue, they will have the public rooms done over in ivory. If the tendency happens to be French modernistic, they employ artists to draw appropriate designs. The furniture of public rooms may be changed annually in order to keep abreast of the latest fashions.

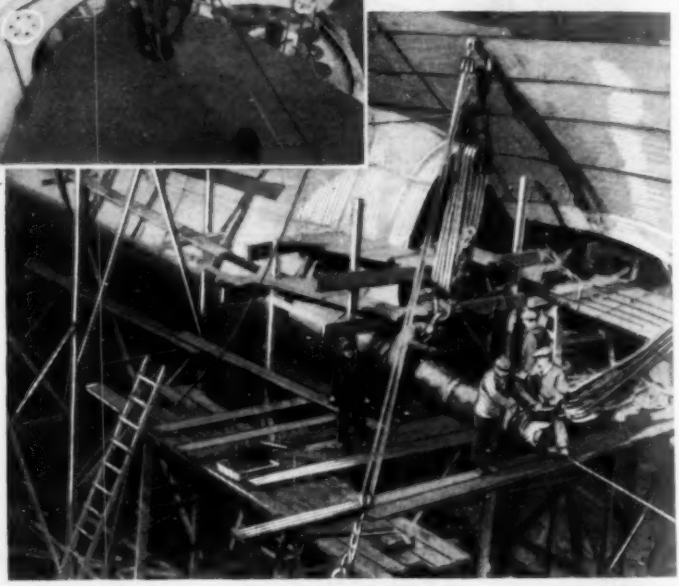
Operators do not halt merely with changing colors and decorations. Permanent structural changes frequently are required. The "Leviathan" started ship-to-shore radio-telephone communication. The "Majestic," not to be outdone, started the first two-way radio-telephone service. The "Bremen" and "Europa" gave their passengers fashionable night clubs. The "Leviathan" opened a mammoth club in which patrons were entertained by two orchestras. This year's overhaul of the "Leviathan" might well be considered a major operation, a beautification and modernization that cost in the neighborhood of $500,000.

The airplane catapault is another innovation that necessitates structural changes in greyhounds. The "Ile de France" started the vogue, and it was taken up by the "Bremen." Soon no crack express liner will be without its aviator and airplane.

Stock-ticker rooms on shipboard call for more elaborate wireless equipment and extra public assembly space.

The science of ship operation becomes so specialized that owners train their personnel for particular jobs. The responsibility of managing public rooms is intrusted to skilled stewards, for the fur-





Courtesy U. S. Lines

Members of the "Bremen's" Crew Boarding Unsinkable Lifeboats for a Demonstration, and Workers Overhauling the "Leviathan's" Propellers

nishings of one salon may cost $100,000; nevertheless, they are changed as often as fashion dictates.

The "Majestic's" lounge is one of the greatest rooms afloat. It measures seventy-six by ninety feet, with a ceiling twenty-six feet high. The dancing space in this room accommodates a hundred couples. Five men are regularly assigned to the care of this room and its sixty-two tables, 310 seats and 1,000-pound carpet. Every spring it receives a thorough renovation as well as new furnishings to replace those which are soiled or out of style.

To the mechanician, the most impressive phase of spring cleaning is the overhaul of external equipment. The underwriters and the government demand a thorough examination of life-saving equipment, especially lifeboats and preservers. Davits are tested, and the boats lowered to the dock wall, where they are painted and their provision lockers restocked with matches, flares, fresh water in air-tight cans, food in tins, signaling equipment, and a mast to which a sail can be attached. On large vessels, some lifeboats have small engines and wireless equipment.

Since a ship's hull receives the ocean's heaviest brunt, no expense is spared in its care. Every rivet is examined for signs of corrosion or rusting. Loose ones are removed and replaced. George H. Bates, vice president of the United Dry Docks, Inc., recently invented a "Strongback Hydraulic Bull Riveter," for use where many new rivets are necessary to the repair. Under water pressure, this riveter applies the equivalent of 100 tons to the rivet head, and another advantage over the old riveter is that it presses the plates more tightly together than was possible heretofore.

It costs around $30,000,000 to build a modern liner. The making and fitting up of such a ship will need:

At least 30,000 tons of steel.

Ten miles of carpet.

Ten thousand electric-light fittings.

Three hundred electric motors in addition to the propelling turbines.

Miles of the finest timber.

Twenty thousand each of table crockery and cutlery items.

Her power station must produce enough current to provide light for a town of 100,000 people.

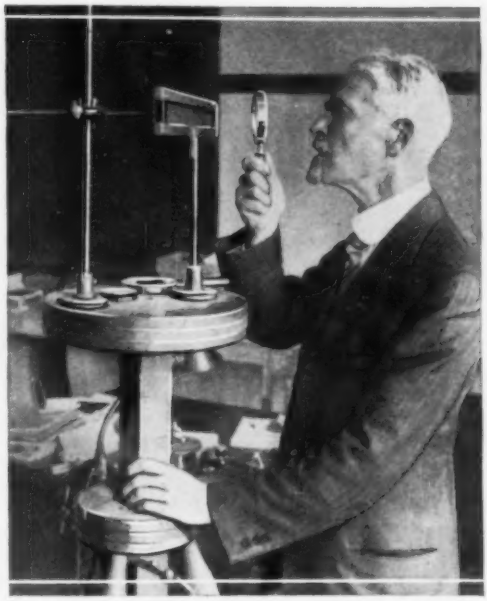
This gives an idea of the vast expenditures required in the upkeep of these floating palaces which uphold the dignity and prestige of a nation.

LIGHT RAYS FROM AUTO LAMP TIME RACING CARS

For timing the speed of racing automobiles, a French clock firm has invented a system which utilizes the rays of light from an ordinary auto headlamp. The apparatus consists of a chronometer and a printer which marks hour, minute, second and fractions of a second on a moving paper band. The racing car passes in front of a light ray projected from the headlamp of a standing auto, thereby establishing an electric contact which actuates clockwork moving the hammer of the chronograph. The light from the auto falls on a photo-electric cell, and when the racer interrupts the ray, a relay

Car-Timing Apparatus Set Up for Clocking a Race, and Close View of the Apparatus

automatically closes the printer circuit, causing the printer to jot the time.



Dr. Samuel J. Barnett, of the University of California, Studying Magnetic Effects Produced by Light Rays

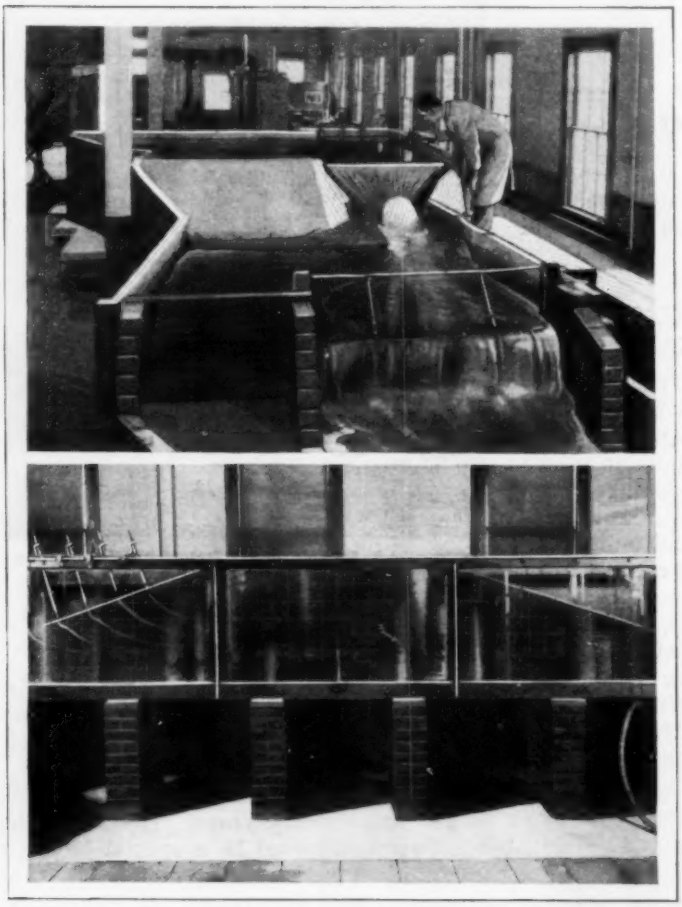
MYSTERY OF MAGNETISM LAID TO ELECTRON'S SPIN

That the phenomenon of magnetism is a result of the spinning of electrons about their axes is the conclusion of Dr. Samuel J. Barnett, of the University of California, who has been studying the problem for more than twenty years. His research has been conducted in a special laboratory constructed without metal. In the accompanying illustration, Doctor Barnett is examining rays of light focused from an instrument fifteen feet away and producing magnetic effects on the transparent bar in front of him.

SELF-FILLING REFUSE TRUCK ELIMINATES DUST

German inventors have introduced a cylindrical garbage truck that fills and empties itself without tipping, to eliminate dust and the spread of germs. The body contains a large, double-flanged screw by which it is divided into four spaces. The screw is turned by transmission from the truck engine. For filling, the screw is driven in one direction and for emptying, in the other. At the rear end, is a filling door and conical receiver which does not revolve.

BIG ENGINEERING PROBLEMS SOLVED WITH MODELS



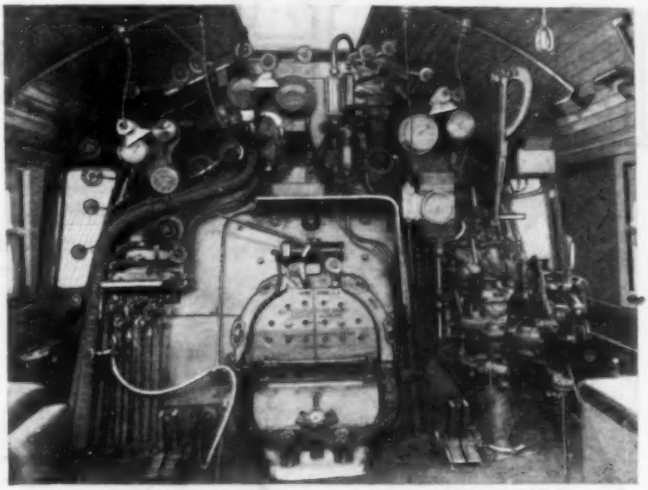
Above, Model of Dam in River Hydraulic Laboratory with Conditions at the Site Duplicated; Below, Model Section of a Proposed Dike

America's first river hydraulic laboratory, established last November by Prof. K. C. Reynolds, at the Massachusetts Institute of Technology, is already demonstrating its dollars-and-cents value in big engineering projects.

For instance, there is the new hydroelectric development of the Delaware Power company, now under construction on the Mongaup river, in New York state. The problem turned over to the river hydraulic laboratory was the designing of a spillway for the dam, that would direct the current to such a course that the rushing waters could not scour away the soft bank and river bed and undermine the structure foundations. In the laboratory, Professor Reynolds built a miniature of the river and dam, on a scale of one to sixty. Every natural condition obtaining at the actual site of the proposed dam was duplicated exactly in the model. The weaker bank was built up of the same materials as those on the Mongaup, and the rock ledge was simulated in concrete. Then the dam itself and the spillway were put in according to approved construction. A head of water corresponding to that in nature was started through and the scouring effects noted. Gradually the shape of the spillway and the apron at its bottom was changed, until a design was achieved that threw the current away from the weak bank and also prevented washing of the gravel on the river bed. So the engineer could go ahead with confidence that his structure would stand up.

The city of Hartford, Conn., wished to enlarge its aviation field. The only land available was subject to overflow at times of high water in the Connecticut river and was soft and boggy, during even the driest weather. The city engineers proposed building a dike, 10,500 feet along the river bank and 4,500 feet inland across the lower boundary of the field addition, from materials taken from the river bottom by dredges. Every engineer knows that any dike of earth construction will leak to a certain extent. The problem turned over to Professor Reynolds was whether or not this seepage could be controlled by a drain at the rear of the dike and a pump to throw the seepage water back into the river. In the laboratory, a tank, twenty feet long and four feet wide, with one side of plate glass, was constructed. A quantity of the

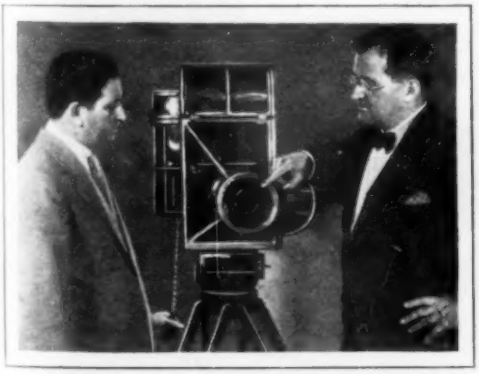
materials proposed to be used was shipped up from Hartford and pumped into the tank under exactly the same conditions that would obtain under actual construction. The result was a section of the dike, on a scale of one to fifteen, within the tank. Water was then introduced on one side of the miniature dike. The rate of seepage was easily measured. In order to gain exact knowledge of the course of seepage, bright-colored dyes were introduced along the face of the dike. The seepage lines, traced by the color, gave the best location for the drain, and the measured rate of flow disclosed the best type and capacity of pump to be installed.



Interior of Cab of a Modern Locomotive That Is Almost Frictionless, Being Equipped Throughout with Roller Bearings

SOUNDPROOF CAMERA WEIGHS BUT THIRTY-SEVEN POUNDS

Inclosed in a case of a celluloidlike material, a soundproof motion-picture camera that weighs but thirty-seven instead of the usual 500 or so pounds, has been introduced at a western studio. It can easily be handled by one man, may be used for indoor or outdoor work, and the case is also proof against water and fire. The motor is practically noiseless, but such sound as it does make, is effectively kept from the camera.



Soundproof Motion-Picture Camera That Tips the Scales at Only Thirty-Seven Pounds

ROLLER-BEARING LOCOMOTIVE HAS LIVING QUARTERS

As an experiment, a locomotive equipped throughout with roller bearings recently was placed in service by an eastern railroad. For an added feature, the almost frictionless engine has a section of its tender fitted up as living quarters for the men composing its crew.

ARCTIC WAS ONCE TEMPERATE BUT NEVER TROPICAL

Old ideas that ancient arctic climates once were tropical have been disproved by scientific studies which indicate that they once may have had a temperate climate, but never a tropical one. These regions could not have been tropical, if for no other reason than that they have practically continuous night for several months, which would have starved the plants for lack of sunlight. An examination of all kinds of fossil plants from the far north has shown that the great majority belong to temperate genera, and such tropical trees as were found are also known to thrive in the temperate zone. In the more recent geological periods, fossil plants found in the arctic included such trees and shrubs as alder, sweet gum, beech, oak, elm, maple, hickory, tulip tree and sassafras.

Dog Heroes of

Arthur T. Walden with "Chinook," Famous Lead Dog, and Litter of Puppies Born in the Antarctic

By JOHN T. BRADY

HOME from the Antarctic, Arthur T. Walden, chief sled-dog driver of the Byrd expedition to the south pole, caressed the last harness worn by his grand old dog "Chinook."

It wasn't much to look at, just a few straps sewed together, with the name "Chinook" crudely printed with a pen on the saddle girth, but to Walden it is the most precious and sacred relic of the greatest adventure of an adventurous life, even though he has several articles which were carried over the south pole.

For somewhere in cold, bleak Antarctica, in a crystal casket, beneath a blanket of snow, the lion-hearted husky, who filled that harness so heroically that his name and fame are known to dog lovers from pole to pole, is sleeping his last, long sleep. The wailing voice of the blizzard sings his requiem, the south pole itself is his monument.

the White Hell

How "Chinook's" glorious career ended with his strange disappearance on that last adventure with his master is one of the most touching sagas of polar exploration, and is best told in Walden's own words. But before beginning the story, he told me of the heroic work done by sled dogs to make the Byrd expedition a success and why it would have failed without them.

"Without sled dogs, the headquarters at Little America could never have been established," he declared, "and but for them the geological expedition under the leadership of Dr. Laurence M. Gould could not have been accomplished."Incidentally, Admiral Byrd, on his arrival at Panama City, was quoted as saying that "the geological survey, made by dog team, was the outstanding feat of the whole expedition."

Alert Expression of Typical Sled Dog, One of the Hardiest of the Species and a Faithful Servant When Properly Trained

With the temperature averaging thirty to forty below zero and blizzards raging frequently, sled dogs carried Doctor Gould and his party of four dog drivers a distance of 1,300 miles in four months, though many dangerous crevasses had to be crossed en route and the journey had to be made in short stages, after outpost depots or caches of food and supplies had been established.

Near the Queen Maude range of mountains, the crevasses were especially numerous, and some were so wide that sledges and men had to be roped together and large knots tied in the ropes for the men to grasp in case they should break through the thin crust. Sometimes a whole string of dogs would be stretched across a crevasse like a suspension bridge, and it was not unusual for a couple of dogs to start fighting while hanging in midair.

It was in the pulling and hauling of hundreds of tons of freight from the supply ships to the site of Little America, however, that the sled dogs proved that they

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"Lady," One of the Best Dogs with the Byrd Antarctic Expedition and Her Five Fine Pups, Born in the Snowy South

are still essential to the success of polar exploration, though the airplane has supplanted them as a means of conveying man to the poles.

When it was realized that a heavy tractor intended for freight hauling was of little or no use, the entire burden of transporting the elaborate equipment for the headquarters camp from the supply ships to the Barrier fell upon the shoulders of the sturdy, courageous huskies.

And when an auto truck, equipped with endless treads on the rear wheels and runners on the front axle instead of wheels, broke down soon after it started to lay caches of food at intervals in the direction of the pole, so that Admiral Byrd might pick them up in case he had to make a forced landing on his polar flight and walk back to Little America, the sled dogs carried on this important work of safeguarding the daring aerial explorer's life.

When the expedition first reached the Bay of Whales, the nearest the "City of New York" could get to the Barrier was twelve miles. The time to get the camp established was limited to the few remaining weeks of the antarctic summer and the dog teams were worked feverishly. In fact, for a while, they had to make two trips a day to and from the Barrier, or a total distance of forty-eight miles over pretty rough ice, with loads of from 2,000 to 2,500 pounds, or more than 200 pounds to a dog, as there were usually nine huskies to a team.

During this rush "Chinook" was in harness as leader of Walden's team every day, and on the hardest kind of pulling he did magnificent work. Not once did he shirk, or as his master put it, "his traces were always taut." Moreover, he was a great inspiration to all the other dogs.

"The old dog seemed to sense that there was need for hurry," Walden continued. "And I took fully as much pride in his performance on that freight-handling job as I did when he led my racing team to victory over the fleetest Canadian huskies in the first International Sled-Dog Derby.

"But when the heaviest part of the hauling had been done, I noticed that the strain had told on him. His hair had turned quite gray and he was getting deaf. So, when he began to slow up on the return trips to the ship with the empty sleds, I decided that he had earned a rest. Accordingly, I began breaking in 'Ballarat,' one of his promising sons, to take his place as leader of my team.

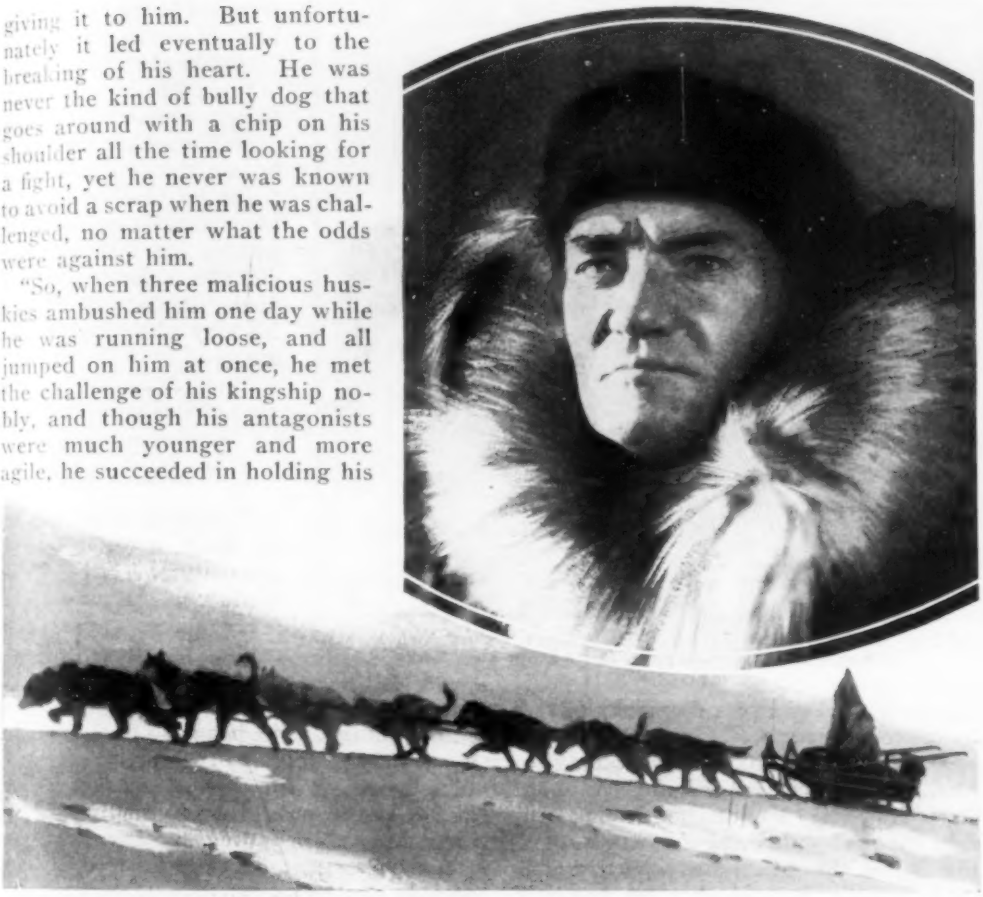
"'Chinook' didn't show the least sign of jealousy when I put his son in his time-honored place, and apparently he was content to be recognized as the 'king' dog of the pack, or the one that all the other dogs respect and fear regardless of his position in a team. Of course, he knew instinctively that no other dog could usurp his place in my affections so long as he lived. But there came a day when he realized that he was in danger of being deposed from his throne as king.

"By that time 'Ballarat' was fairly well broken in as a leader and I was letting 'Chinook' run loose except when I needed his strength in emergencies to start an extra-heavy load or pull it over a pressure ridge.

"He enjoyed his freedom and I enjoyed

giving it to him. But unfortunately it led eventually to the breaking of his heart. He was never the kind of bully dog that goes around with a chip on his shoulder all the time looking for a fight, yet he never was known to avoid a scrap when he was challenged, no matter what the odds were against him.

"So, when three malicious huskies ambushed him one day while he was running loose, and all jumped on him at once, he met the challenge of his kingship nobly, and though his antagonists were much younger and more agile, he succeeded in holding his own for several minutes of terrific battling. But he finally went down and would have been killed in short order if I had not happened on the scene.



Top Photo, © The New York Times and St. Louis Post-Dispatch

Walden, Who Was with the Byrd Antarctic Expedition, Drove Dogs in the Klondike; Below, a Dog Team and Driver, Making Time over a Smooth Stretch

"I believe that when 'Chinook' was downed by those three blood-hungry huskies, he realized only too well that the end of his reign as king was near at hand. They had humbled his pride. I jumped to the conclusion that he had started the fight. So, I chastised him, and that must have hurt his feelings all the more.

"Later I learned that I had wronged him, but it was then too late to make amends. He was gone from my life forever, leaving my heart as empty as this harness.

"By a striking coincidence 'Chinook's' disappearance occurred on his twelfth birthday. On starting from Little America to go to the ship that day, I put him in harness at the head of my team to limber him up a bit and kept him there until after I got past the worst of the pressure ridges on the trail. Then I turned him loose with just his collar on, and he began to lag behind.

"After that, I didn't give him another thought until I had gone a couple of miles or more. Then I looked back, but he was nowhere in sight. I had passed three or four teams coming from the ship, however, and I reasoned that he had turned and followed one of them back to camp.

"But when I returned to Little America in the afternoon, I learned that he hadn't shown up there, and none of the other drivers had seen and recognized him, although one man said he had noticed a

Sled-Dog Mother, Proudly Surveying Her Young; Trained from Earliest Infancy, the Dogs Quickly and Eagerly Learn Their Tasks

shape that looked like a dog away out on the ice to the west.

"Knowing 'Chinook's' keen homing instinct, I wasn't particularly anxious about him at first, and I went to bed feeling confident that he would come into camp sometime during the night. But when I awoke next morning to find that he was still missing, I began to get real worried over his absence and went on a hunt for him.

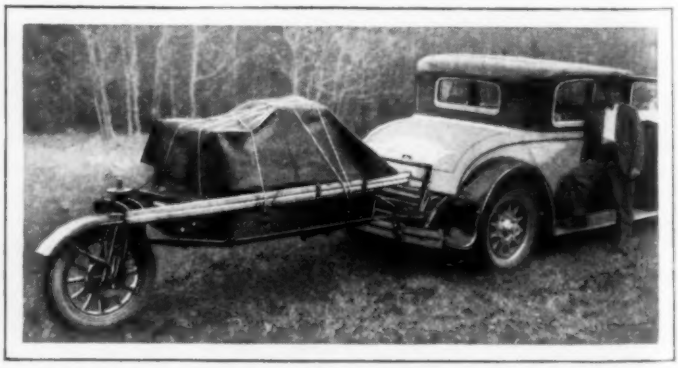
"All the other teams that could be spared joined in the search, but a bad storm came up early in the day and obliterated all tracks. The airplanes began to fly about that time, and Admiral Byrd ordered all the flyers to be on the lookout for 'Chinook,' but no sign of him was ever found.

"He was always so careful in avoiding crevasses that I don't think he fell into one, and there isn't a chance that he lost his way. It is my firm belief that he was broken-hearted over his failure to hold his own in a fight and so he deliberately wandered away to die by himself in the most God-forsaken spot on earth.

"One of the strangest things about his disappearance is that, the night before, he woke me up twice by placing one of his forepaws on my face just as his father 'Kim' did the night before he died. Perhaps that was his way of trying to tell me good-by."

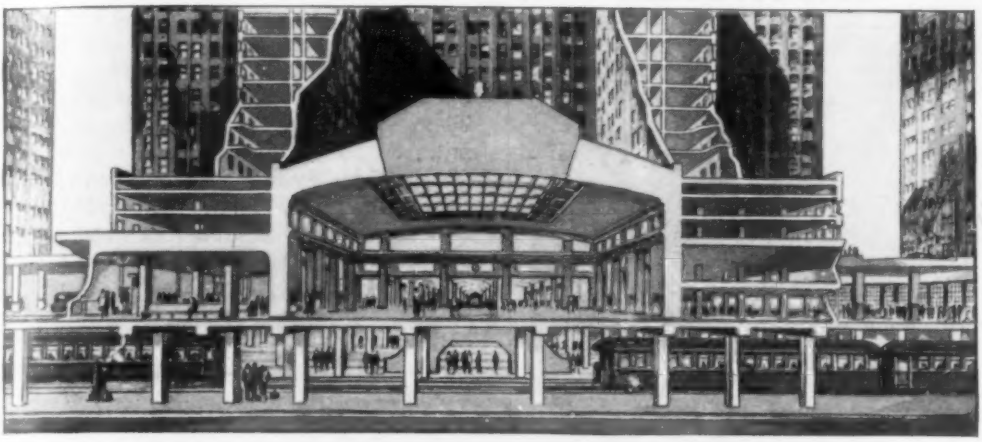
TRAILER FOR AUTO TO PREVENT SIDESWAY

Moving as a part of the car itself, a one-wheeled auto trailer has been introduced. An automatic arrangement causes the trailer to turn without sidesway on curves, and the wheel adapts itself to forward or backward running. The head end of the trailer is securely coupled to the car, the fastenings being of the ball-and-socket type, and at the front are two folding legs that drop down to support the trailer when it is not in transit. The unit weighs 350 pounds and has a capacity of half a ton. It is stanchly made of electrically welded steel and is attractively finished. The trailer is well adapted to business as well as to pleasure uses. Three strong braces on each side secure the wheel to the body and are strong enough to stand shocks.



One-Wheeled Trailer Loaded and Attached to Car; the Single Wheel Adjusts Itself to Backing or Forward Travel

WHOLE CITY UNDER ONE ROOF IN NEW TERMINAL



Cross-Section Drawing, Showing How Trains and Other Conveyances Pass under Union Terminal Building in Cleveland; a Hotel, Bank, Office Building and Station Are under One Roof

A huge hotel, two eighteen-story office buildings, an eighteen-story bank structure, and a vast railroad terminal building with a tower fifty-two stories high compose what is virtually a "city within a city" under the recently completed union terminal building in Cleveland, Ohio. All these buildings are interconnected by passageways so that persons may pass from one to the other without going out of doors. A large department store and a $7,000,000 post-office building are still to be erected on the site, which was occupied by several hundred smaller structures before the huge terminal was planned.

HOW YOU COULD CIRCLE WORLD IN FIVE MINUTES

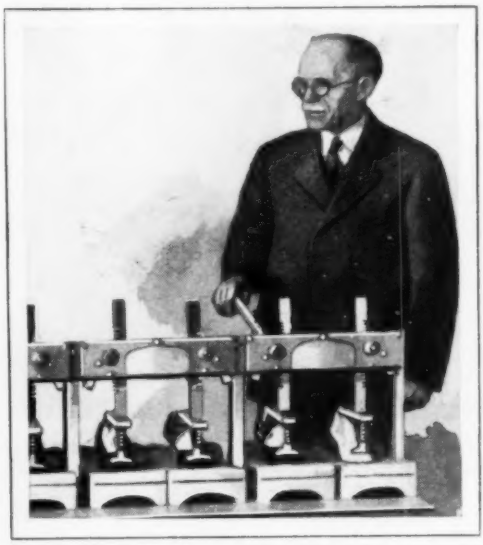
As new means of transportation and communication are being developed, the time required for a trip around the world is constantly decreasing. The German dirigible, "Graf Zeppelin," in 1929 made the journey in twenty-one and one-half days of which only thirteen were spent in the air. J. H. Mears, an American, made the dash by land and water in half an hour under thirty-six days, four days faster than a similar journey made by Andre Jaeger, a German. George Griffith, an Englishman, encircled the globe in sixty-four days, seven hours and twenty minutes, using only ordinary train and steamer service and making the best connections possible on regular trains and boats. In going around the world, the route must be taken into consideration because, at the poles, it would be possible to "go around the world" in five minutes merely by walking around the pole points.

STREET SIGN WITH REFLECTOR VISIBLE NIGHT OR DAY

Easily seen at all times of day or night, a street sign, introduced in Los Angeles, is fitted with a reflector which projects the rays of the sun or of electric lights through the glass on which the characters are lettered. This plan saves the expense of special illumination for the sign.

Street Sign Fitted with a Reflector, Which Makes It Visible by Night as Well as Day

SOLES OF SHOES VULCANIZED LIKE AUTO TIRES



Shoes in Special Rack for Vulcanizing the Soles; Several Pairs Can Be Treated at One Time

To vulcanize shoe soles in somewhat the same manner as automobile tires are treated, an Ohio man has invented a machine which handles several pairs at one time. The operation is said to be easy, and the process prolongs the life of the shoes.

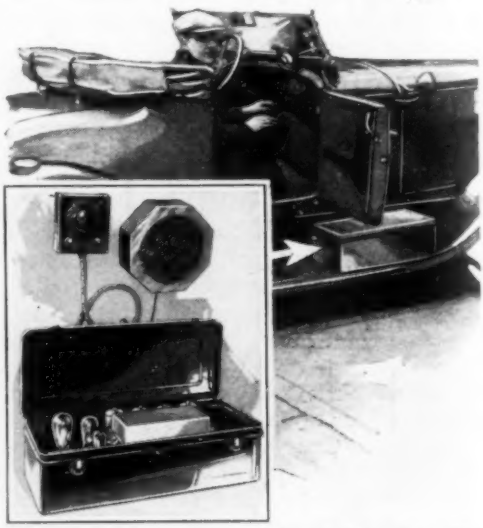
GREAT OPPORTUNITY OF FUTURE SEEN IN CHEMISTRY

Chemists can probably make anything they conceive of, and will certainly make many things they do not conceive of now, according to Dr. Willis R. Whitney, of the General Electric company.

"A something from the sun that we call light, a something from space that we call air, and a something from the earth that we call solutions—these things make green things grow. That is still only half-understood chemistry," he said. "Cows eat the grass and produce milk and the dairy maid makes butter and cheese, but these processes are also only partly understood. We eat such foods, and unwittingly produce bones, tissues and brains, and this is also only partly understood chemistry. Gradually the chemist who makes dyes so permanent that even chlorine cannot bleach them, and has learned how to make ammonia, nitrates, alcohols, ethers, and almost anything, from lime, coal, water, air and electric power, will teach us more about the chemistry of life and better living. A very minor outcome will be the production of milk, butter, cheese, etc., directly from clean chemical elements. Then we will wake up to the fact that milk, as formerly produced, was a very dirty and buggy thing, and that cows were clumsy factories. Chemists nowadays control the quality of iron and steel, paper and paints, dyes and cements, glass and porcelain, oil and gas, water and air, metals and alloys, silk and wool, leather and rubber, explosives and cotton, foods and drinks, fertilizers and fuels, etc. During the past century they have greatly increased their productivity of new things, and so the future will be exciting."

AUTO RADIO ON RUNNING BOARD IS EASILY REPAIRED

Mounted on the running board instead of under the dash, a radio receiver for the automobile is accessible for inspection, adjustment or repair. The dial control operates through a flexible cable from the interior of the car, and the aerial is stretched under the car. A loud speaker may be placed in any handy place. The set is supplied in the kit or knockdown form and may be installed in the rumble seat of roadsters or coupes if desired.



Set Mounted on Running Board, and View of the Dial Control, Loud Speaker and Cabinet

LIGHT'S SPEED CHECKED THROUGH ONE-MILE TUBE

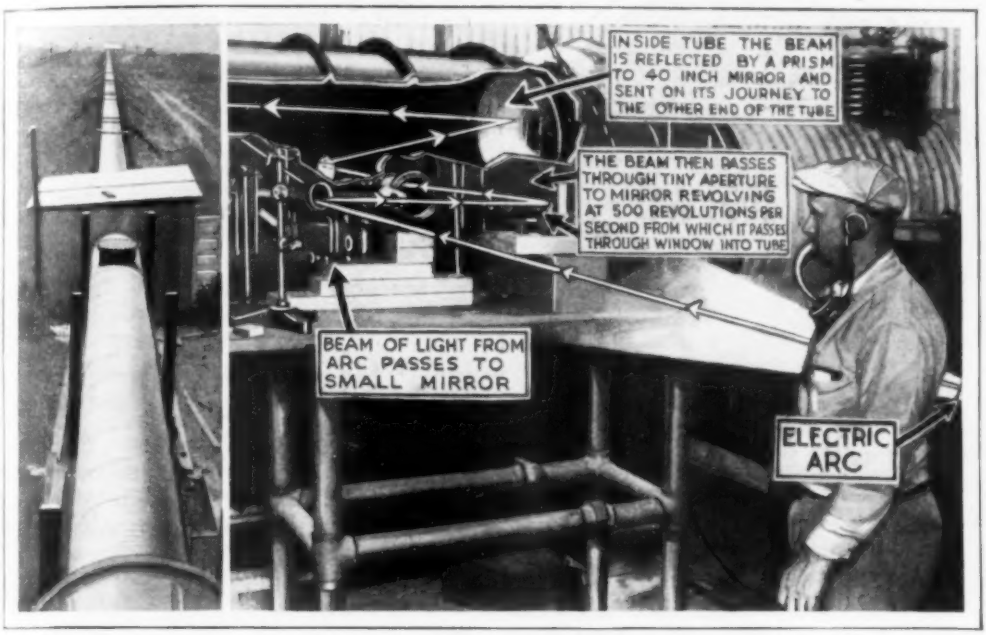

INSIDE TUBE THE BEAM IS REFLECTED BY A PRISM TO 40 INCH MIRROR AND SENT ON ITS JOURNEY TO THE OTHER END OF THE TUBE
THE BEAM THEN PASSES THROUGH TINY APERTURE TO MIRROR REVOLVING AT 500 REVOLUTIONS PER SECOND FROM WHICH IT PASSES THROUGH WINDOW INTO TUBE
BEAM OF LIGHT FROM ARC PASSES TO SMALL MIRROR
ELECTRIC ARC

Photo-Diagram of the Mile-Long Pipe "Runway" Where Speed of Light Is Being Checked, and Arrangement of Mirrors for Reflecting the Rays

By reflecting beams of light through a mile-long pipe line from which the air has been practically exhausted, Dr. Albert A. Michelson, famous physicist, is making further checks and measurements of the speed of light. His previous research has shown that light's velocity is in excess of 186,000 miles per second, but with the improved apparatus set up in California, he expects to make more accurate timing. The light rays are sent back and forth through the tube by a system of mirrors. Creating a vacuum within the passage eliminates interference that might mar the accuracy of the tests.

ALUMINUM PAINT RESISTS HEAT AND KEEPS ITS COLOR

Protection of surfaces from corrosion while at high temperatures is the chief function of a heat-resisting aluminum paint recently introduced. It is prepared from a chemically treated aluminum powder, which will withstand any constant heat up to 2,000 degrees Fahrenheit. Above this temperature, the color turns to a dark gray. The material is applied as an ordinary aluminum paint with a brush, by spray or dipping. As soon as the coated surface comes in contact with heat, the liquid evaporates, and the substance is said to enter the pores of the metal without discoloration or peeling.

ELECTRIC KNIFE'S HOT BLADE HELPS CLEAN GAME

For removing hair or feathers from game, an electric knife has been devised. Its blade becomes red-hot in a few seconds, but an insulated handle and a heat-resistant guard protect the user while he sears the object he is cleaning. The knife is so designed that the blade does not come in contact with the table when laid down, thus preventing damage to the surface.

Girl Wearing Vest to Which a Parachute May Be Attached, Thus Eliminating Bothersome Straps

PARACHUTE ATTACHED TO VEST ELIMINATES STRAPS

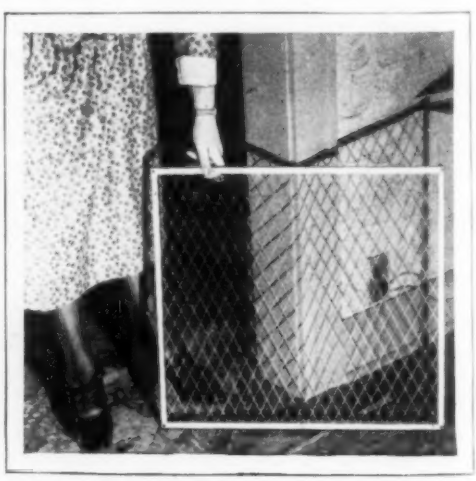
Detachable parachutes that can be quickly fastened or unfastened instead of being adjusted with straps, have been introduced for wear on air liners. They connect by a simple hook arrangement to a special vest which the passenger dons before going aloft.

GNAT'S WINGS HELP TO RECORD HEAT OF THE STARS

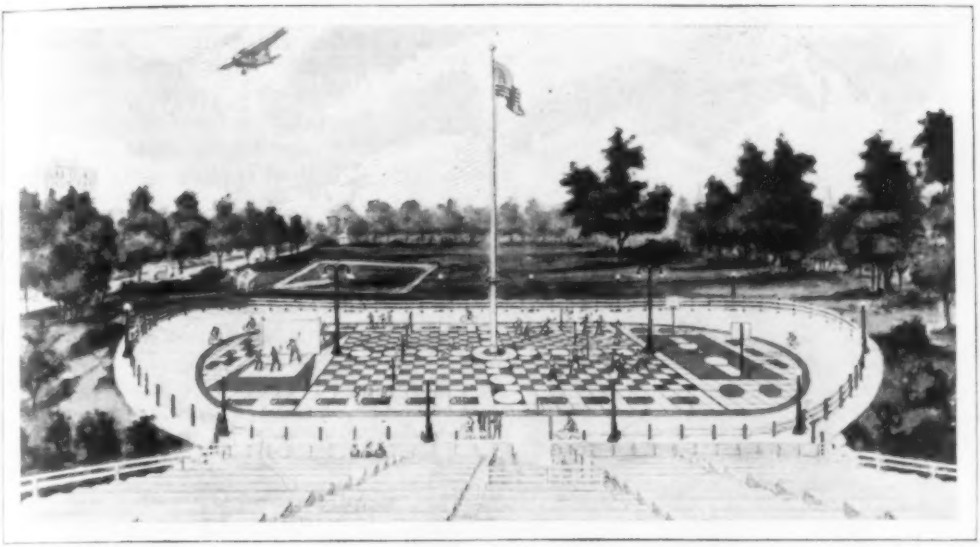
Bits of gold leaf, so light that they float in the air, microscopic threads of bismuth alloys, quartz filaments all but invisible to the naked eye—these are the materials with which C. Hawley Cartwright, of the California Institute of Technology, builds thermometers so sensitive that they detect changes of temperature amounting to only one-two-millionth degree Fahrenheit. Mounted in telescopes focused on distant stars, these delicate instruments, by measuring the radiation of heat, discover not only the temperature of the heavenly bodies, but also estimate the nature of their make-up and the speed of their motions. Two styles of ultra-sensitive thermometers are made by Mr. Cartwright; one, a thermocouple, the other, a radiometer. The action of a thermocouple depends on the curious fact that two wires of differing metals, joined at one end and heated at the junction, generate an electric current. The greater the heat applied, the greater the flow of electricity. Not content with developing the thermocouple to a new degree of refinement, Mr. Cartwright has also made notable improvements in radiometers of the moving type. This meter consists of a small horizontal wheel with four light metal vanes hung from the circumference, all inclosed in a partially exhausted glass bulb. One side of each vane is blackened, while the other is polished. Whenever radiant heat is falling upon the wheel, the black faces of the vanes absorb the light, heating the rarefied air near them. The resulting increase of molecular motion kicks the wheel around, the speed of rotation depending on the intensity of the light. In his radiometer, Mr. Cartwright substitutes for the wheel a short quartz bar carrying two blackened gold-leaf receivers with a mica mirror projecting a beam of light. To prevent loss of heat from the bright backs of the vanes, they are insulated with bits of gnat wings.

ADJUSTABLE SCREEN FITS ANY SIZE DOOR OR WINDOW

Intended as a reinforcement for door and window screens, a coarse-mesh screen now on the market has adjustable sides so that it may be made into square or narrow rectangular shapes. The wires rotate at the points of contact when the sides of the screen are changed.



Adjustable Mesh Screen, Which May Be Changed in Dimensions to Fit into Any Size of Window



©Tomaz F. Deuther

Park Playfield Resembling a Huge Checkerboard Where Many Games May Be Played Simultaneously; Provision Is Made for Handball, Marbles, Hopscotch, Volley Ball and Basket Ball

CHECKERBOARD PLAYGROUND OFFERS MANY GAMES

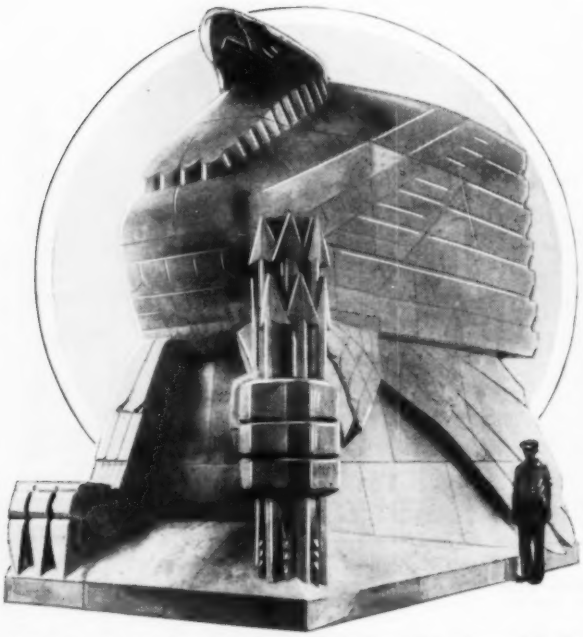
Many games can be played at one time on an interesting concrete field recently constructed in a Chicago park. There are handball courts, marble rings, hopscotch layouts, volley-ball courts and a basketball court, besides a concrete racing track for bicyclists. Eight laps make a mile. A central flagpole, 150 feet high, has a Maypole ring above its base so that the pole may be used for May and other dances. A grandstand at one side of the field accommodates 1,500 persons, while a wide walk, just outside the rail, is large enough for many more spectators. The play space is marked off in red and white divisions, and the border lines are plainly indicated so that many can use the space without interfering with one another.

DOOR OPENS AUTOMATICALLY WHEN APPROACHED

Swinging doors that open automatically as a person approaches and close in the same manner after he has entered recently were demonstrated and are expected to find wide application, particularly in hotels and restaurants where waiters with heavily laden trays must struggle with doors leading from dining room to kitchen. The door is made to open and shut by an electric eye located near it. A ray of light is focused on a photo-electric cell in front of the door. When the ray is interrupted by a person passing between the cell and the source of light, it sets a hydraulic door opener to work through the agency of a relay. The slight current is amplified through three vacuum tubes and sets in motion a small motor which operates the hydraulic device. A control adjusts the time the door is held open.

JEWELERS' LENS ON GLASSES SAVES WEARING "BARREL"

Jewelers and watchmakers who have difficulty in wearing the usual type of "barrel" magnifying glass, are provided with a lens that is attached to the spectacle frame. When not in use, it can be flipped up out of the way where it is ready for immediate service again. If the worker does not wear glasses, he can use the special lens attached to a spectacle frame without lenses.



One of the 200-Ton Eagles, Carved from Limestone Blocks, Which Will Decorate a Memorial Bridge at Harrisburg

STONE-BLOCK EAGLES WEIGH TWO HUNDRED TONS EACH

Carved in thirty-five blocks of limestone each, two huge eagles, weighing 200 tons apiece, have been designed for the soldiers' and sailors' memorial bridge at Harrisburg, Pa. Eight freight cars were required to move them from the mills. The figures are twenty-two feet high.

MOTORBOATS FOR SELF-USE ON PARK PONDS

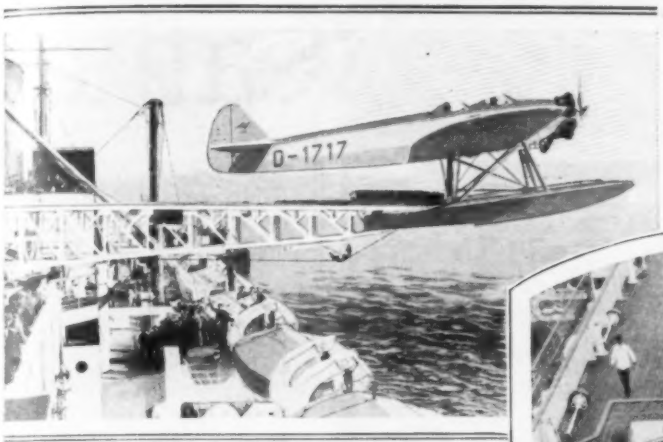
One of the latest water amusements in recreation parks is afforded on a large shallow pool where motorboats may be hired to be driven by the visitors themselves. The craft are ten feet long and of sufficient beam to prevent them from tipping over. Rubber bumpers prevent damage in case of collisions and the boats are driven in every direction at a speed of about five miles an hour. The air-cooled gasoline engines are locked in a closed compartment so that the operator has nothing to do with the starting or stopping of them. The boat is run simply by placing the foot on a clutch which engages the propeller and stops it by removing the foot. The engines are started at the beginning of the day's sport and run continuously unless trouble develops. The sport offers the thrill of being the master of one's individual boat and also helps persons in learning to steer.

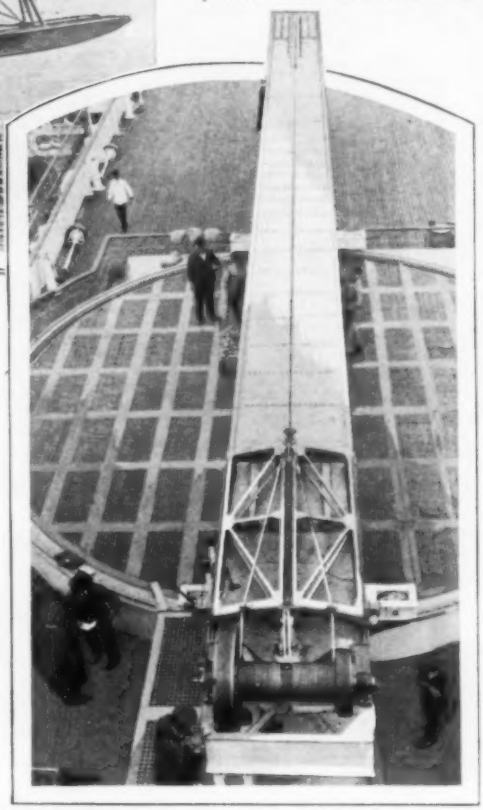
WINGS FOR SKIING ADD THRILLS OF FLYING

Some of the thrills of flying are added to the winter sport of skiing with a pair of wings worn by the ski runner. The wings, made of aluminum by a German inventor, are nineteen feet from tip to tip and enable the wearer to take short flights in the air after gaining sufficient momentum on the skis. They are so constructed that the ski rider is virtually seated in the center of them when he leaves the ground. They are movable from a horizontal position and easily controlled, enabling the rider to change direction of flight.

Ski Rider Equipped with Nineteen-Foot Wings, Which Lift Him into the Air After Sufficient Momentum Is Attained on the Skis

CATAPULT FOR PLANES IS ENGINEERING WONDER





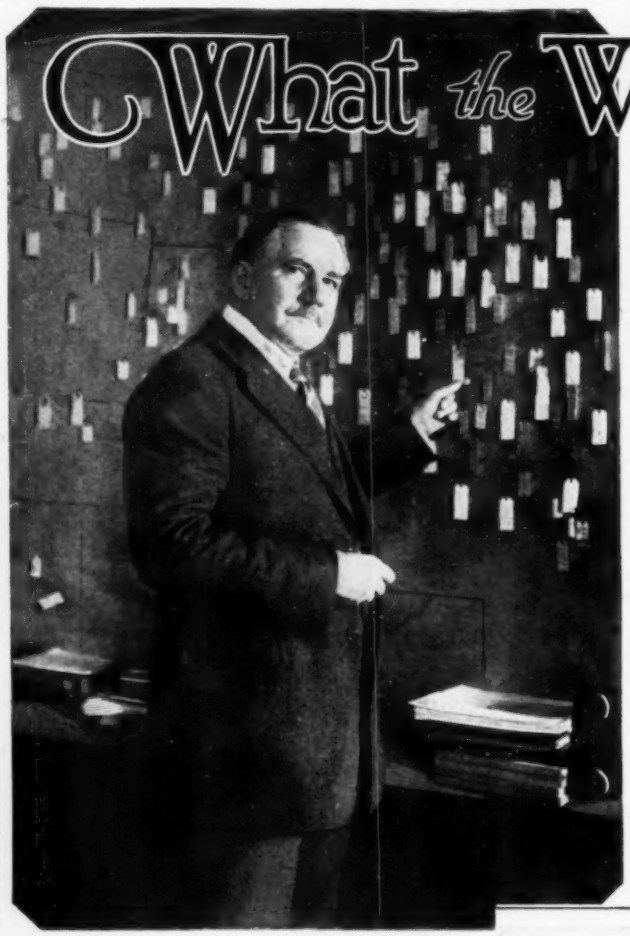
Two Views of a Catapult for Launching Airplanes from a Ship; It Is Light in Weight, but Has Unusual Strength and Dependability

Launching airplanes from the decks of commercial steamers and battleships is no longer a novelty, but few persons are acquainted with the catapult apparatus by which this is accomplished. In designing the equipment for the steamers "Bremen" and "Europa" many engineering difficulties were solved, and experiments were conducted for about three years before a satisfactory machine was made. Light weight, great strength and dependability are necessary factors for successful operation. The catapult consists of four main parts, the rail bearer, starting skid, accelerating unit, or that part which furnishes the forward movement for the plane, and the testing contrivance. The rail bearer, or launching way, is a steel and iron framework and turns on a pivot, so that the planes can be launched into the wind without turning the entire steamer. The skid slides on special shoes along the rails and to it is attached a cable that operates over rollers turned by the accelerating device, or by the motor unit, which functions by compressed air. The testing device is an interesting and important part of the machinery. In brief, it is a flywheel and drum with a cable connection to the skid. To test the catapult before a plane is launched, the skid is connected to the flywheel and shot down the rails. If it turns the wheel with sufficient speed, the operators know that the catapult is working satisfactorily, and the plane can be safely placed on the starting skid.

ROCKETS TO DISPLACE CANNON IN FUTURE WARS

Skyrockets instead of cannon will be used in future wars, if experiments of European engineers are successful. They are making tests to find a method of propelling explosives accurately through the air without using cannon, which are considered almost obsolete because they are too clumsy to move, too easily damaged and too costly. Skyrockets are easily transported and can be landed in a certain area by regulating the powder charge. Such rockets would contain gases, liquid fire, shrapnel or smoke-producers.

What the Weather



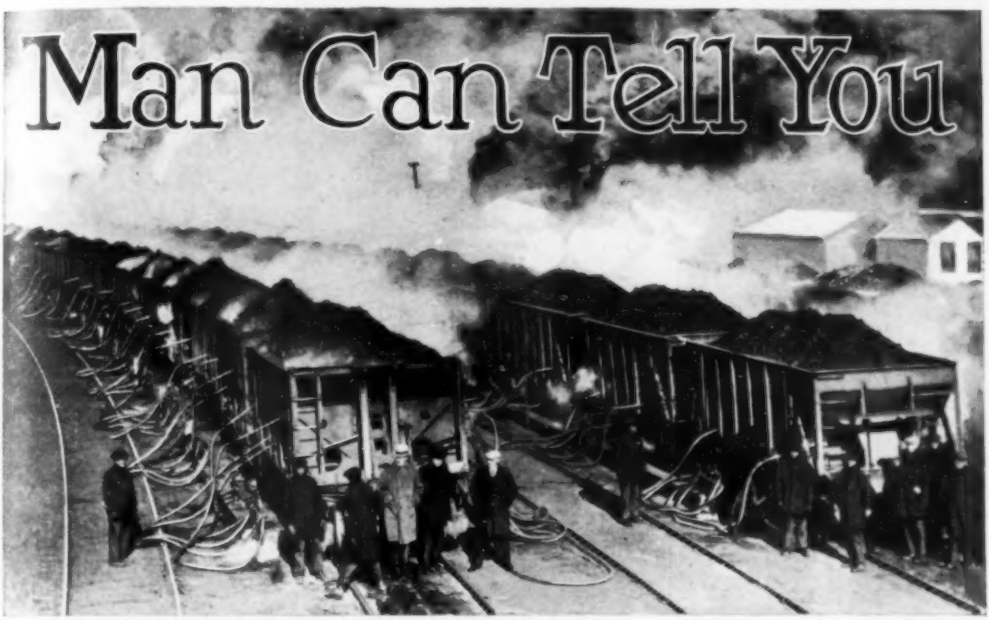
By CHARLES FITZHUGH TALMAN

THE WEATHER BUREAU does more than predict weather and record climate. It helps the public make an intelligent and profitable use of both weather forecasts and climatic statistics for an endless variety of purposes.

One of the biggest problems the bureau ever tackled was that of cutting down the enormous losses sustained by merchants in the shipment of goods susceptible to injury by extreme temperatures, including not only foodstuffs but also a wide range of other commodities. A single cold wave in winter sometimes entailed losses of millions of dollars on goods in transit and some hot waves in summer were almost equally disastrous.

The temperatures at which perishable goods are liable to damage vary greatly for different commodities; also with their condition when shipped, the length of time they are in transit, and various other factors. A large fund of information on these points and also on methods of packing and protecting the goods, collected from the merchants themselves, was digested. The next step was to start the system of "shippers' forecasts" that is now so familiar. These forecasts are issued from weather-bureau stations during the seasons of the year when dangerous temperatures may occur. This undertaking proved to be of revolutionary benefit to the mercantile world, and the rail-

C. F. Marvin, Chief of Weather Bureau, with Map of Stations; Below, Inspecting Orchard Heaters



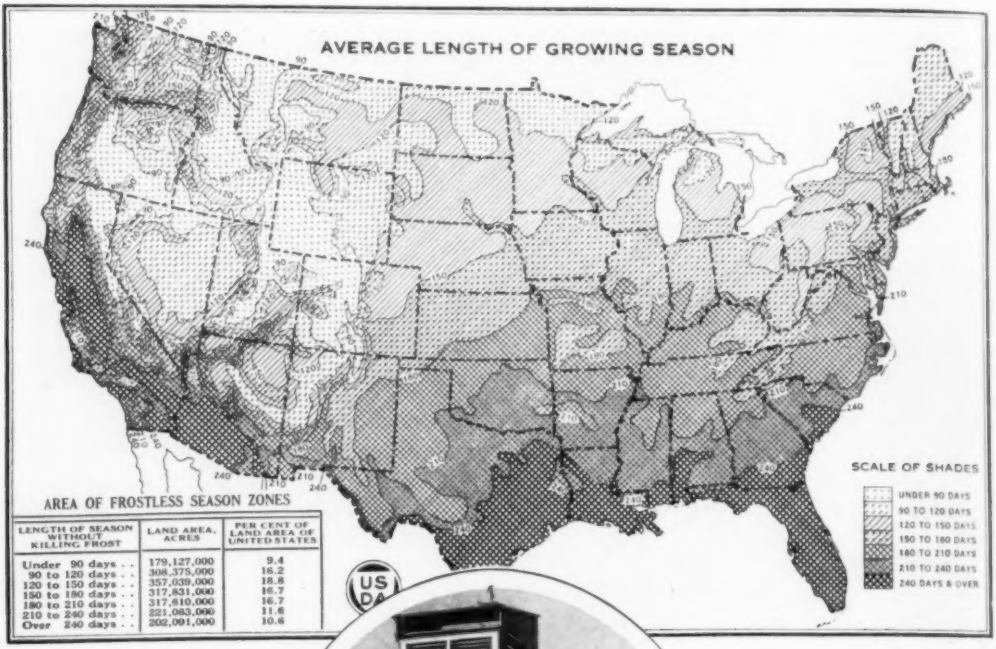
Thawing Iron Ore with Steam on Duluth Ore Dock; Cold-Weather Forecasts in Spring and Fall Have Reduced This Expensive Process to a Minimum

roads have helped to make it effective by refusing to accept perishable goods for shipment in ordinary freight cars when the forecasts indicate danger of injury.

A few years ago the weather-bureau men at Ithaca, N. Y., were asked to study methods of spraying fruit trees against scab. The spores of this fungus disease are active only when moist. The conclusion was therefore reached that the right time to spray is just before a rain. If spraying is done at that time, the fungi begin to grow and are killed by the poison, while if the spray is applied in dry weather it is wasted, as the fungi are not affected by the poison in their inactive stage. The outcome of this investigation was that the bureau undertook a system of special rain forecasts for the apple growers of seven counties in New York state, who were spending $3,500,000 a year in spraying their trees.

To jump to another industry and another part of the country, the iron trade on the Great Lakes, which is famous for its efficient methods, at one time suffered serious losses every year through ignoring weather. Early and late in the season of navigation large quantities of frozen ore accumulated on the docks at upper lake ports, causing much expense for thawing and costly delays in loading vessels. Finally the operators took counsel with the weather man at Duluth. Under his advice they began keeping close watch of the temperature forecasts during the colder months. Whenever a freeze was in sight, only enough ore was shipped from the mines to the docks to load vessels ready to receive it. Great savings have been effected by this plan.

Within the last two years the weather bureau has been carrying on such diverse enterprises as making daily dust counts at several of its stations for the American Society of Heating and Ventilating Engineers; measuring the thickness of ice deposits on wires for the National Electric Light association, and testing the amount of pollen in the air at various places for an organization engaged in the study of hayfever. It is hardly necessary to mention here such outstanding and well-known activities as the aid it renders, through special frost-prediction services, in the economical use of orchard heaters, its studies and forecasts of "fire weather" in the forests, and the elaborate services of



AREA OF FROSTLESS SEASON ZONES

LENGTH OF SEASON WITHOUT KILLING FROST	LAND AREA, ACRES	PER CENT OF LAND AREA OF UNITED STATES
Under 90 days . .	179,127,000	9.4
90 to 120 days . .	308,375,000	16.2
120 to 150 days . .	357,039,000	18.8
150 to 180 days . .	317,831,000	16.7
180 to 210 days . .	317,610,000	16.7
210 to 240 days . .	221,083,000	11.6
Over 240 days . .	202,091,000	10.6

Climatic Chart, Especially Helpful to Farmers and Fruit Growers; Below, Instrument Shelter on Skyscraper

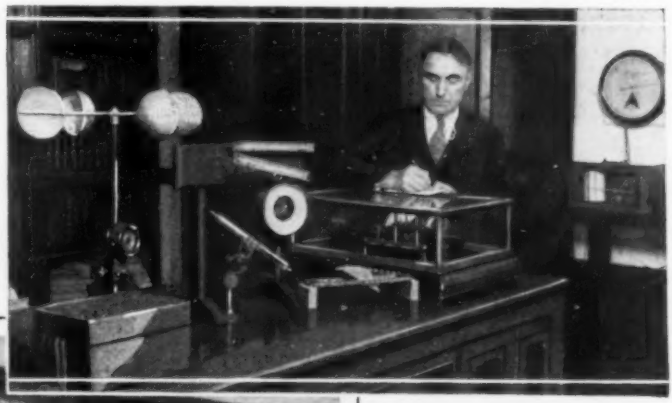
reports and forecasts recently established along the airways for the benefit of aviation.

The story is told of a certain American manufacturer of library paste who embarked upon extensive shipments of his product abroad without any preliminary study of climatic conditions in the foreign markets. Some of it went to desert regions of the near east, where, on account of excessive evaporation, the paste dried so quickly when it was applied that it had no adhesive quality. To introduce more moisture at the time of manufacture would have made the paste too thin and subject to spoilage. Laboratory experiments were undertaken, a slow-drying paste was developed, and the new product turned out to be so much better than the old one that today more of this paste is sold in the United States than any other.

It is rare indeed that failure to consider the climatic factor in developing a new market leads to any such happy result. Most American businessmen realize that adaptation to climate is a most important consideration in the sale of many commodities. Not long ago the weather bureau aided the General Electric company in making an elaborate analysis of American climatic records in order to determine the periods of the year when weather calling for the use of electric fans normally prevails.

The recent rapid growth of weather insurance in its various forms has presented the bureau with a number of difficult problems. Such enterprises as rain and hail insurance are extremely hazardous unless based on very detailed climatic statistics, such as are hardly available at present for any part of the country. The

insurance companies can, however, use to advantage certain kinds of knowledge already possessed by meteorologists. Thus weather-bureau records show that the great majority of tornadoes travel in an easterly to northeasterly direction along a path that may be hundreds of miles long but is rarely more than half a mile wide. Hence a company writing tornado insurance should distribute its risks more or less at right angles to this direction, so as to avoid the possibility of ruinous losses in any one storm.



Above, Observer Consulting Quadruple Register That Makes Continuous Record of Wind Direction and Velocity, Rainfall and Sunshine; Below, Aviator Consulting Teletype Weather Report

An exploration of weather-bureau correspondence files would bring to light a veritable gold mine of information supplied to the public in response to innumerable requests, and furnish striking illustrations of the many-sided relations between weather and the affairs of mankind. Here are a few specimen queries that have lately received the bureau's attention:

A large engineering firm wants to know the average dates limiting the period when concreting can be done safely without cold-weather equipment in all parts of the United States; also the extreme dates in exceptional years.

A manufacturer of "flexible glue" requires temperature data for all parts of the country, as this product must be made differently for use in different climates.

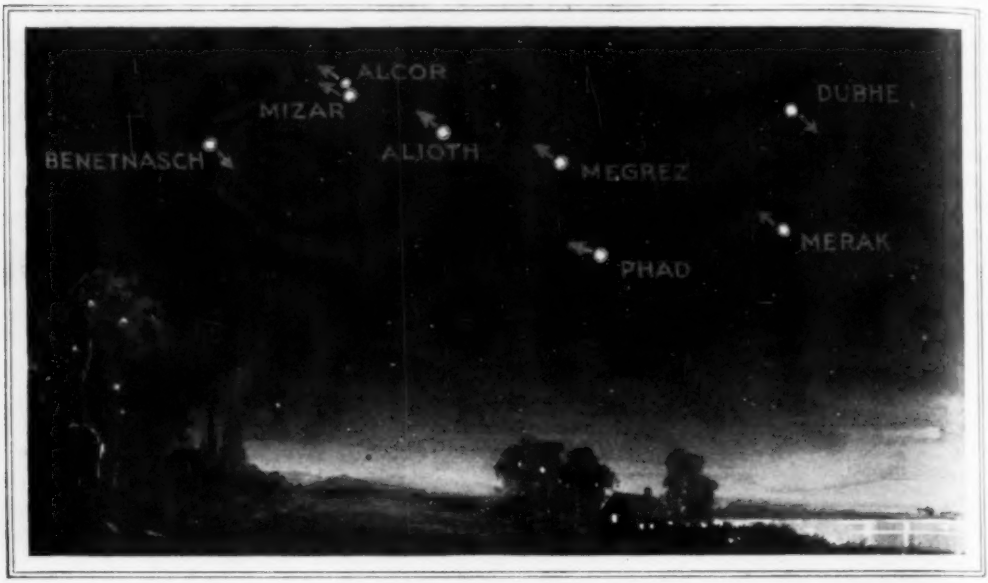
A chemical manufacturer wants to know of a place in the United States, with railroad facilities and a fair labor supply, having the lightest possible rainfall and the driest air throughout the year; these being the ideal conditions for a plant he is about to establish.

A post and fence dealer wants to know at what time in the fall the ground freezes in different parts of the United States.

A dealer in summer clothing, including strawhats, bathing suits, etc., asks for data with which to combat the idea that retailers should not buy a strawhat after July 1 or a bathing suit after July 15.

Of course, the problems submitted to the weather bureau are not all commercial or industrial. Many questions come from home seekers and health seekers. Many are purely domestic, many are purely scientific—and many are fantastic.

HOW STARS OF THE BIG DIPPER ARE BREAKING UP



Scientists Have Found That the Big Dipper in the Sky Is Gradually Breaking Up, the Stars Composing It Moving in Different Directions as Indicated by Arrows

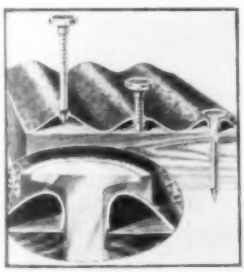
The Big Dipper, most spectacular and best-known of the constellations of our northern skies, is breaking up, pulling apart, going to smash. Recent astronomical measurements show that the two stars at the opposite ends of the dipper, known to the star-wise as Benetnasch and Dubhe, are moving at high velocity in a southerly direction, while the inside stars are moving as a group uniformly in a northerly direction. Because of the remote distances of these objects, the movements are not apparent to the naked eye, and no doubt the dipper appears to the casual observer very much as it appeared to the Egyptians who built the pyramids. But when photographs are made of the constellation through powerful telescopes and these measured and compared with other photographs over a period of years, slight changes in the stellar positions show up. These indicate velocities of many miles a second, and it is unmistakable that in a few thousand years the constellation will have shifted its figure so considerably that the familiar pattern we know so well will be no more. It is commonly said that the Big Dipper consists of seven stars, but if you look closely you should be able to count eight. The second star from the end of the handle shows up as two stars to a keen pair of eyes—and indeed the ability to see the two without the aid of a glass is a test of good eyesight. This second star of the dipper was the first double star, or binary, ever discovered by the unaided eye. The brighter star of the pair is Mizar, and its smaller twin is Alcor. Though these companion stars seem almost to touch each other, they are in fact separated by a space 16,000 times the distance between the sun and the earth—in round numbers, about one and a half million million miles. Mizar is so far off, that its light must travel more than seventy-five years to reach the earth. Dubhe and Merak are generally known as "the pointers" because a line drawn from Merak through Dubhe points to the North Star. Of course, they will no longer be reliable pointers after Dubhe has traveled a few thousand years in one direction and Merak a few thousand years in another. But by that time, astronomers say, the present North Star will have ceased to be the Pole Star, and navigators and surveyors will no longer be especially interested in it. Why not? Well, it seems that the earth, as it rotates on its polar axis, is wabbling in a way that is gradually

shifting the position of its axis with reference to the stars. It is computed that, by about the year 14,000, the bright blue-white Vega will be our north-pole star.

NEW SOURCE OF POWER IS SEEN AS NEXT GREAT DISCOVERY

Man has nearly reached the limit of development of steam power and will soon discover another and much more efficient method of transforming energy to his uses. This far-reaching prediction was made recently before the world power conference in Berlin by C. F. Hirshfeld, Detroit research engineer. Scientists can now calculate the limit of power production possible under theory yet to be applied, and, in fact, could attain this limit if metals strong enough to stand the increasing pressures and temperatures were available. Judging from human history, a radically different process for power development may be expected before the limit with present methods has been quite reached. Mr. Hirshfeld did not indicate what the development might be, but apparently was not considering any possibilities already projected, such as the gathering of heat from the sun, or the use of temperature differences between surface and deep water in the tropics or between sea water and air in the arctic.

NAIL THAT SEALS HOLE MAKES ROOFING LAST LONGER



Underneath the steel head of a nail, now on the market, is a bit of lead that seals the hole when it is driven in, to protect against moisture. The nail is especially intended for all kinds of roofing. The nail can be driven through sheet steel without punching a hole.

¶A machine which examines eggs under light, separates them according to size, quality and weight, and counts and dates them was exhibited in Germany recently.

Spectacles That Aid the Deaf; They Have Shields to Cup the Ear for Better Hearing

EAR SHIELDS ON SPECTACLES AID HARD OF HEARING

Cupping the ear with the hand in order to hear more clearly is a common practice among persons afflicted with defective hearing, and this aid is provided without the use of the hand in a spectacle attachment introduced in Germany. The bows are arranged with shields of transparent material and hold the ears in a cupped position, the guards at the same time forming an additional chamber to catch the sound. The device can be worn with comfort and has the advantage of being without batteries.

FLARES AS WEATHER SIGNALS WARN AIRPLANE PILOTS

Before radio service was installed along an eastern air route, weather signals were broadcast to flyers by a system of flares. One warned of bad weather ahead, two were shown when the pilot was advised to land at once, and three gave the signal to return to the base port. The flares were sufficiently brilliant to be seen from high altitudes.

Self-Rocking Cradle Contains an Electric Motor, and There Are Drawers in Base for Clothing

ELECTRIC CRADLE FOR INFANT RELIEVES MOTHER

Mothers who spend part of their day in rocking the baby now may turn that task over to the electric cradle and go about their housework. The cradle, consisting of a bassinet mounted on an upright frame, differs little from the conventional kind except that it contains a motor connected to a rocker arm, which functions when connected to a light socket. In the base of the stand are handy drawers for the baby's clothing.

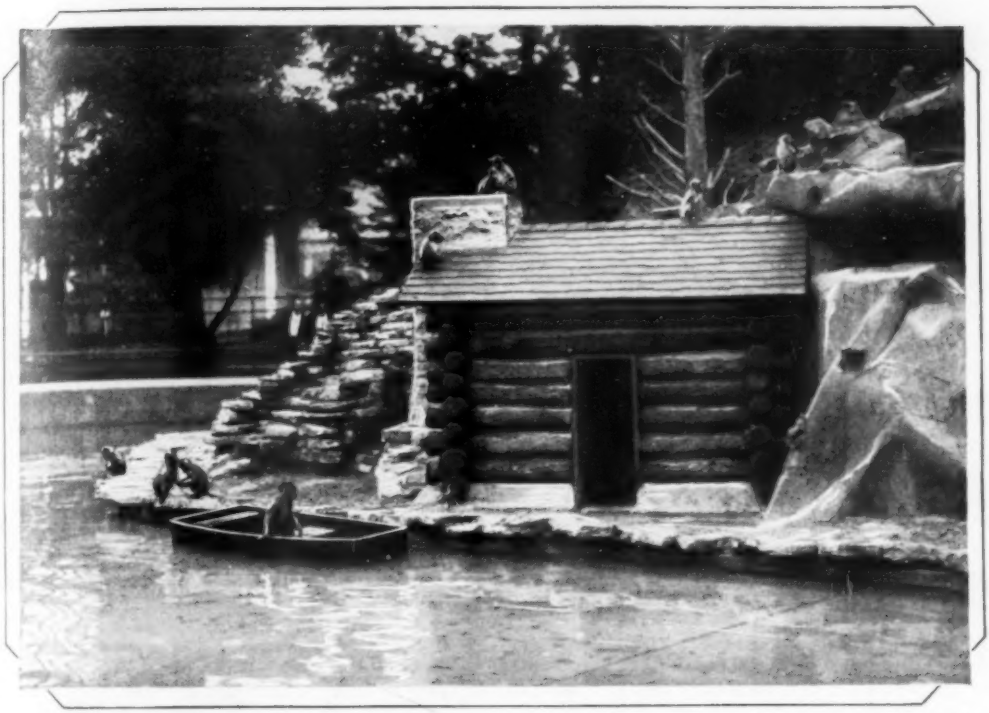
SECRET OF DWARF JAP PINES LIES IN SPECIAL DIET

A "starvation" diet and a special method of planting are secrets of producing dwarfed trees, such as are grown in Japan, the miniature specimens being less than a foot in height though they may be over 500 years old. Experts in the botanical gardens of the University of Pennsylvania have been investigating the dwarf pine and other trees and have discovered how they are grown. The pine cutting, for instance, is but three or four inches long at the start and is planted in a ball of heavy clay, tightly packed about the end that is to form the root. The clay ball is then placed in a shallow dish of water and the cutting permitted to root in the clay, which is kept under water at all times. When the roots have started, the cutting is planted in poor soil. The shoot is thus kept on a starvation diet and grows but little taller than it was at the start. Small sticks are arranged to hold the small branches out straight. Within a year, the dwarfed tree will have assumed the mature appearance of one a century old. The sprig is not planted in an upright position but on a slant and the pot is placed with the sprig pointed away from the source of the sunlight. In this way, the twisted and gnarled stem which characterizes this type of tree is produced.

CAMERAS AIMED LIKE GUNS FOR AIR PHOTOGRAPHY

Cameras are considered almost as important as guns in "shooting" objects from the clouds, and the instruments are mounted with elaborate precision just as guns are sighted and fired. One of the special services of air photography is in bombing from airplanes. The camera makes an accurate record of the ground to be covered and also helps register the hits and misses, so that the bombers can improve their marksmanship.

Aiming One of the Monster Aerial Cameras Developed Especially for Army Use



Where Monkeys Enjoy Boat Rides and Live in a Log Cabin; Scene on Monkey Island at the Cincinnati Zoological Gardens; the Cabin Marks the Entrance to a Cool Dry Cave

AN ISLAND HOME FOR MONKEYS IN CINCINNATI ZOO

One hundred monkeys in the Cincinnati zoological gardens now make their home on a special island recently constructed for them. Monkey island, in the center of a large pool surrounded by a three-foot wall sloping inward to keep the monkeys from crawling out if they swim to shore, is 120 feet long and sixty-five feet across. The monkeys can jump fourteen feet, so the moat between the island and the wall was made twenty-five feet wide. A cabin door leads to the entrance of a cave where the residents find protection from the weather. Small boats, water balls and canoes are furnished the monkeys for amusement.

FERTILIZER HELPS TREE MOST NEAR TIPS OF ROOTS

Experiments conducted in the botanical gardens of the University of Pennsylvania show that fertilizer seems to do the tree the most good when it is placed around the circle formed by the outer edges of the foliage instead of close to the tree trunk. This outer ring roughly marks the boundary of the root tips underground, and this was found to be the best place for fertilizer as well as for water.

CLIP ON POCKET PENCIL SERVES AS LETTER OPENER

Attached to a pencil now on the market is a hinged clip that not only serves to hold the pencil to the pocket, but, when turned back on its hinge, is transformed into a convenient letter opener. The clip fits snugly against the pocket and is easily adjusted for its double purpose. It maintains tension at all times and is practically indestructible.

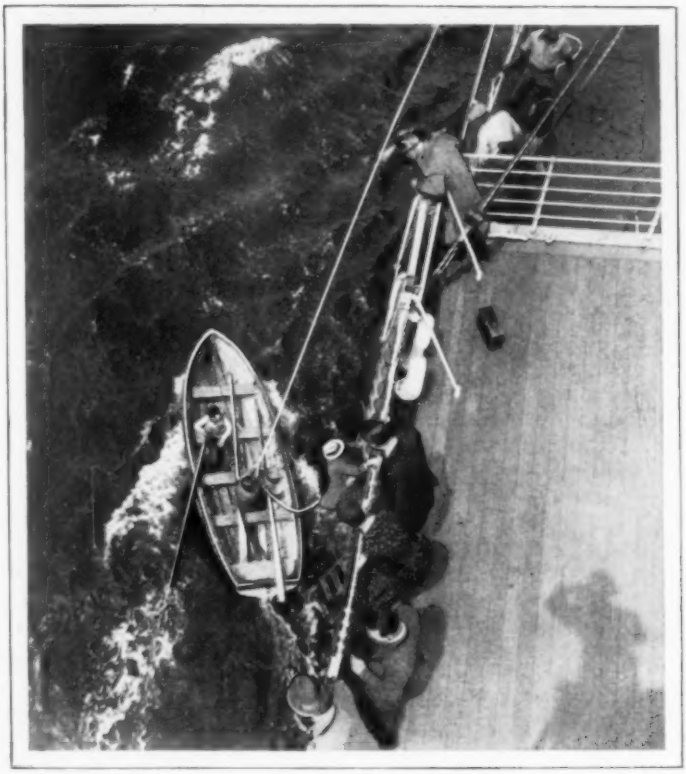
STAGE OPEN TO SKY
AUDITORIUM FOR 5,000 SPECTATORS ROOFED OVER AS USUAL
Players' Dressing rooms at back and sides
Central Stage for Biblical Tableaux Analogous to Main Action
City Street masking outbuildings
City Street
Tableaux based on famous paintings
House of Pilate, Roman Chief
House of Annas, Jewish High Priest
Front Seats at sides entirely reserved for villagers

Front and Part of the Backstage of Theater at Oberammergau, Scene of the Famous Passion Play; as Many as 500 Actors Occupy the Stage at One Time in Some of the Episodes of the Play, Which Consists of Eighteen Acts and Twenty-Five Tableaux

© Popular Mechanics

ROOM AT SEVENTY MAY STILL BE COLD

Although the room thermometer may register seventy degrees on a winter day, the occupants may still be too cold for comfort. Prof. A. C. Willard and A. P. Kratz, of the University of Illinois, recently explained why this is so and pointed out the need for more efficient temperature measurements during the winter in the average home. Under the practice of most heating calculations, temperatures are generally taken at the "breathing line," or about five feet from the floor. But this is not a fair measure during intense cold because, in many homes, the inside surfaces of exposed walls, windows and other units are radiating cold that definitely affects the occupants of the rooms. For instance, at two feet six inches above the floor, the "comfort line," the temperature is generally lower than it is at the breathing line.



Pilot Climbing aboard Vessel to Guide It into Port; Scaling the Ladder Is Not Always an Easy Task, Especially in Rough Sea

CLIMBING UP "JACOB'S LADDER" TESTS PILOT'S SKILL

Pilots who conduct ocean liners to their piers through the maze of traffic in New York harbor face their first test of skill when they meet the incoming vessel in a small boat and clamber up the side of a swaying "Jacob's ladder" lowered to them from the ship, for, seamen though they are, they have not all the monkey-like agility of the old-fashioned sailor. An unusual photograph, taken from above, was recently made of such a feat as the pilot boarded the new Grace liner "Santa Clara," after its trial trip from Camden.

PORTABLE PLAYER FOR PIANO FITS IN SMALL CASE

Quickly attached to an ordinary piano, a portable player arrangement, devised by a British inventor, operates directly upon the keyboard over a range of eighty-five notes. Its pneumatic action manipulates the keys as a roll is unwound. The outfit weighs less than most portable radio sets.

Inventor with Player Unit That Is Adjusted on Top of Piano Keys for Automatic Operation

Front and Part of the Backstage of Theater at Oberammergau, Scene of the Famous Passion Play; as Many as 500 Actors Occupy the Stage at One Time in Some of the Episodes of the Play, Which Consists of Eighteen Acts and Twenty-Five Tableaux

Folding Automobile Table Used as Footrest and Extended for Service in the Car

FOLDING TABLE IN AUTOMOBILE ALSO SERVES AS FOOTREST

Used as a rest for the feet when closed, a folding table that may be set up in a few seconds, in the rear of the front seats of the automobile, has been introduced. If desired, the table may be taken out of the car and set upon the ground. It is light in weight, sturdy, and simple to adjust, and provides ample leg room.

TALKING FILM SHOWN ON TRAIN TO ENTERTAIN PASSENGERS

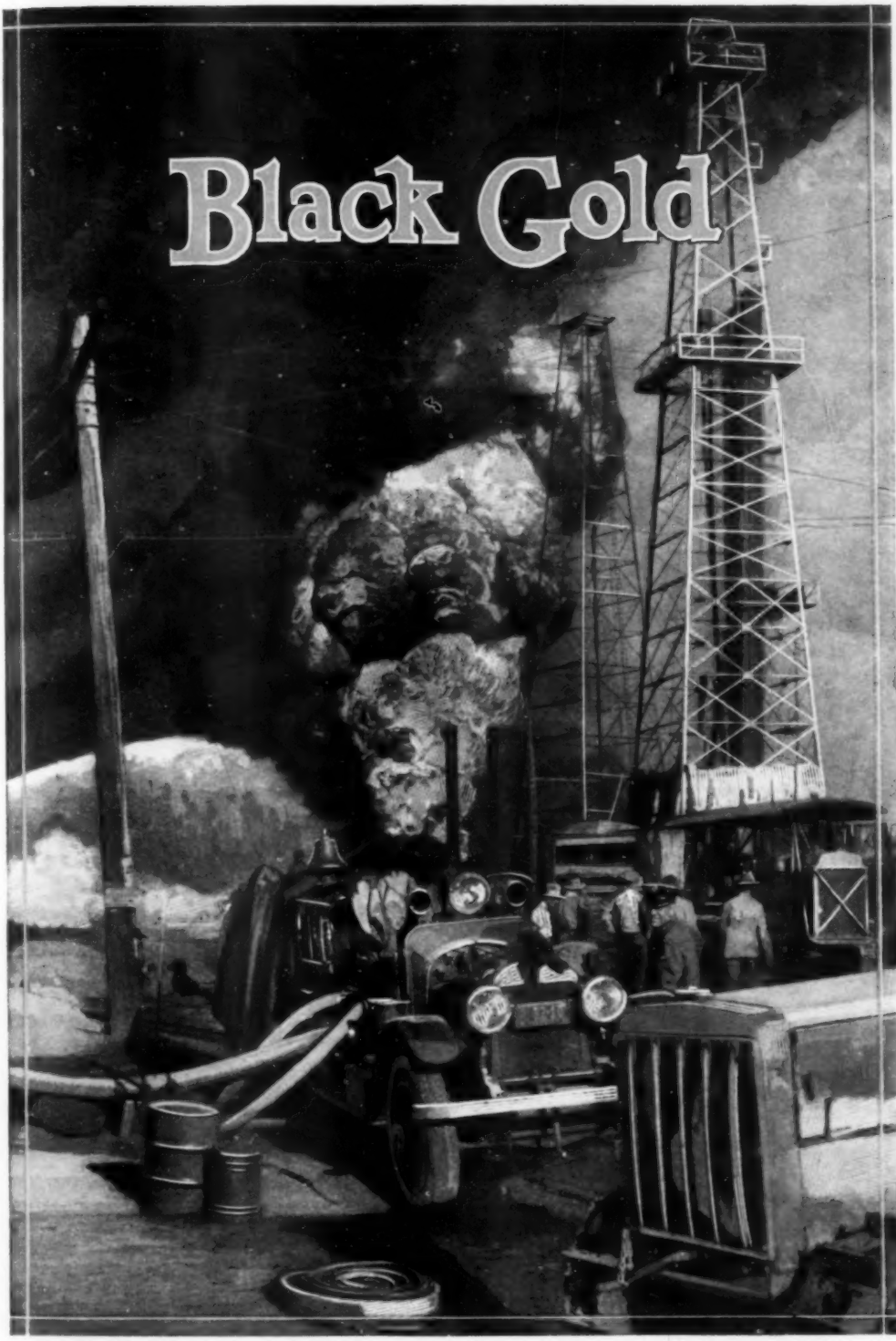
Talking movies recently were exhibited for the first time aboard a moving train in experiments by the Chicago and Northwestern railway to determine the feasibility of offering sound films in special movie cars for the entertainment of passengers on some of the limited trains. In the tests, an ordinary day coach and a standard portable projecting machine and sound equipment were used, and even with this experimental arrangement, music, conversation and sound effects were received clearly and plainly by passengers, the noise of the speeding train not offering the amount of interference naturally expected. Silent movies for trains are quite commonplace, and the successful tests with the talkies led railroad officials to predict that the sound-insulated movie car soon may be as much a part of the equipment of a transcontinental train as the diner.

POWDER SERVES AS COUPLING INSTEAD OF GEAR SHIFT

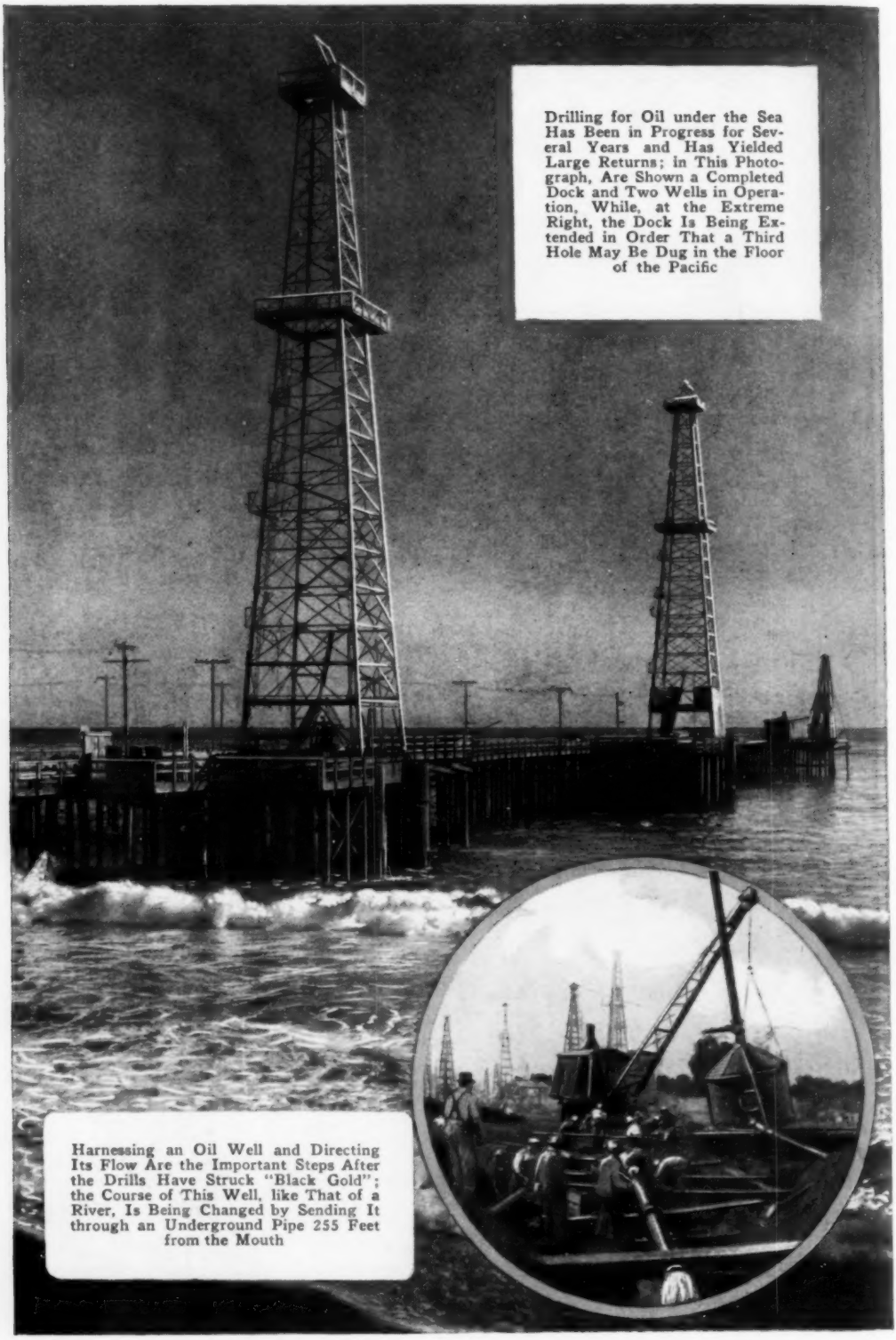
As a substitute for the ordinary gear-shift systems, the peculiar properties of a fine metal powder have been utilized by two Swedish inventors in an elastic coupling device for a wide variety of machine-shop and other units. The device consists of a double cylinder, one part of which is fixed to the motor axle and the other, a shell that contains the metal powder, inclosed by another cylinder, is attached to the driven shaft. When set in motion, the powder is thrown around until it gradually builds up enough pressure to establish a firm cohesion between the two cylinders, locking them together in a strong grip, thus eliminating the need of the usual gear shift. The coupler has been subjected to severe tests and is expected to be of chief use in connection with gasoline engines employed in the iron and stone industries as well as in textile, printing and other manufacturing

Sectional View of the Gear-Shift Substitute, and Device Employed on Cream Separator

activities. The start is made smoothly and easily and considerable economy is effected, it is claimed, through a reduction of power losses.

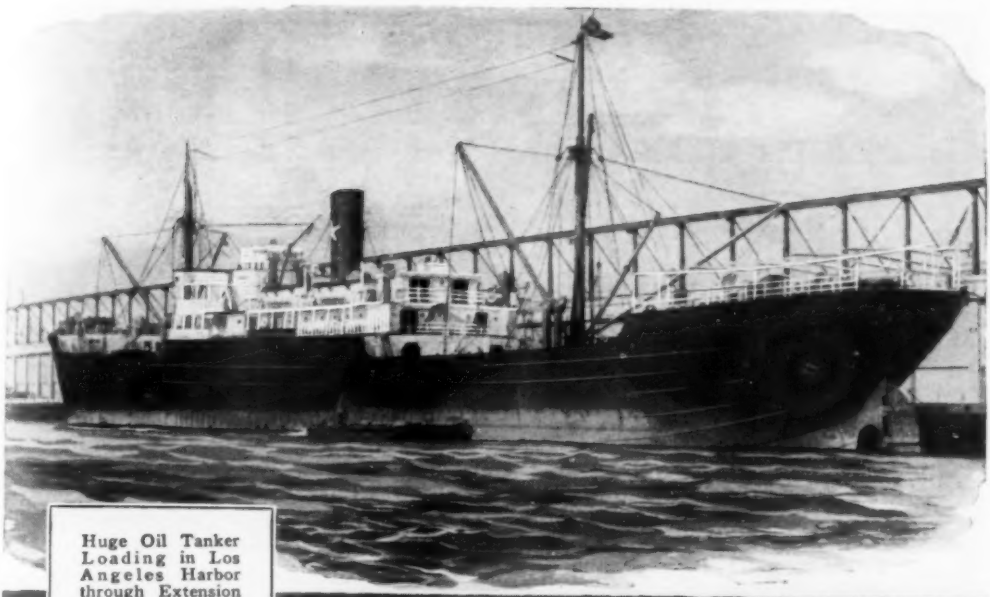


All Available Fire Apparatus Is Brought into the Oil Field When a Disastrous Blaze Starts; Close View of a Blazing Gusher in the Santa Fe Springs Area

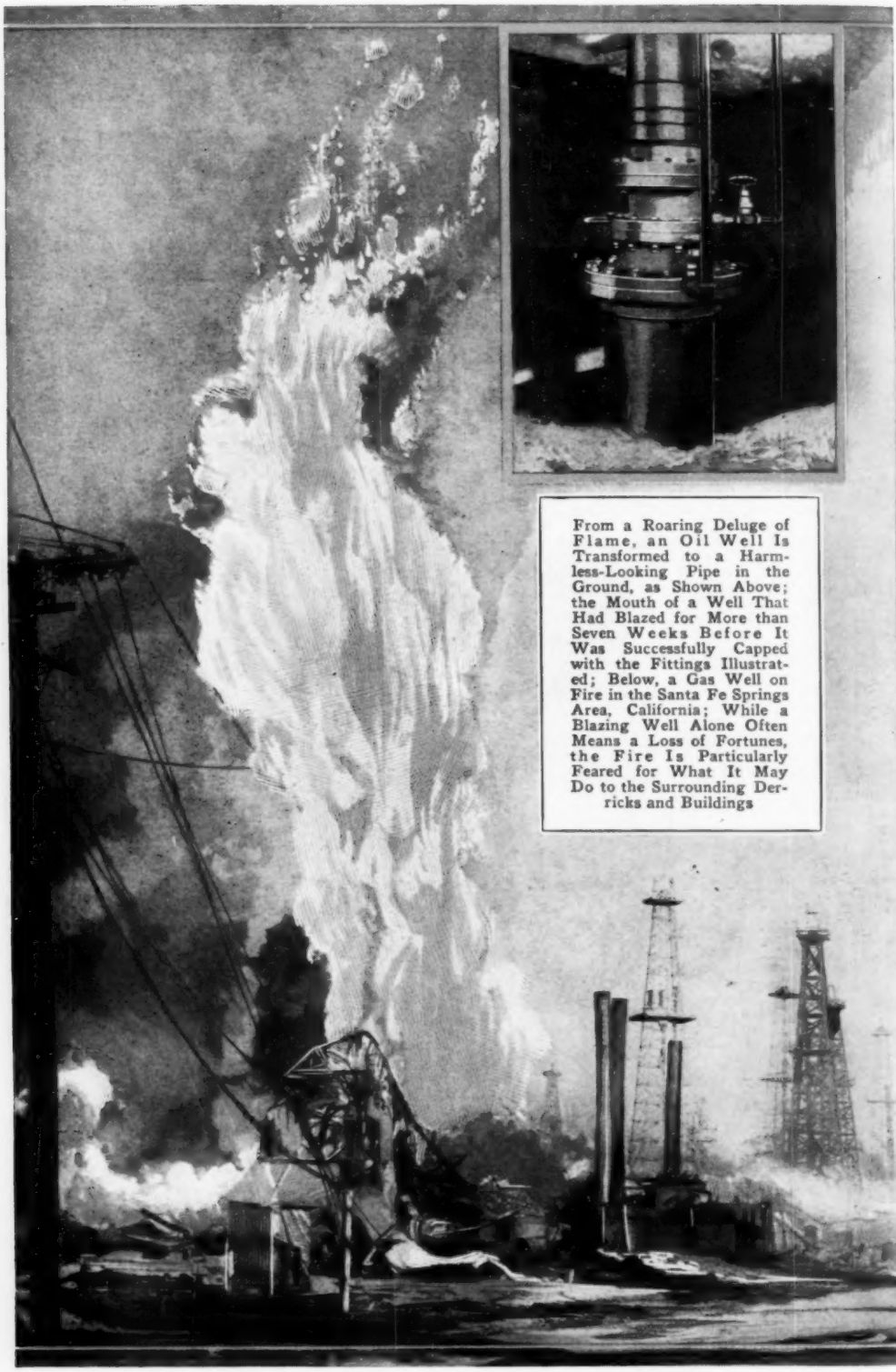


Drilling for Oil under the Sea Has Been in Progress for Several Years and Has Yielded Large Returns; in This Photograph, Are Shown a Completed Dock and Two Wells in Operation, While, at the Extreme Right, the Dock Is Being Extended in Order That a Third Hole May Be Dug in the Floor of the Pacific

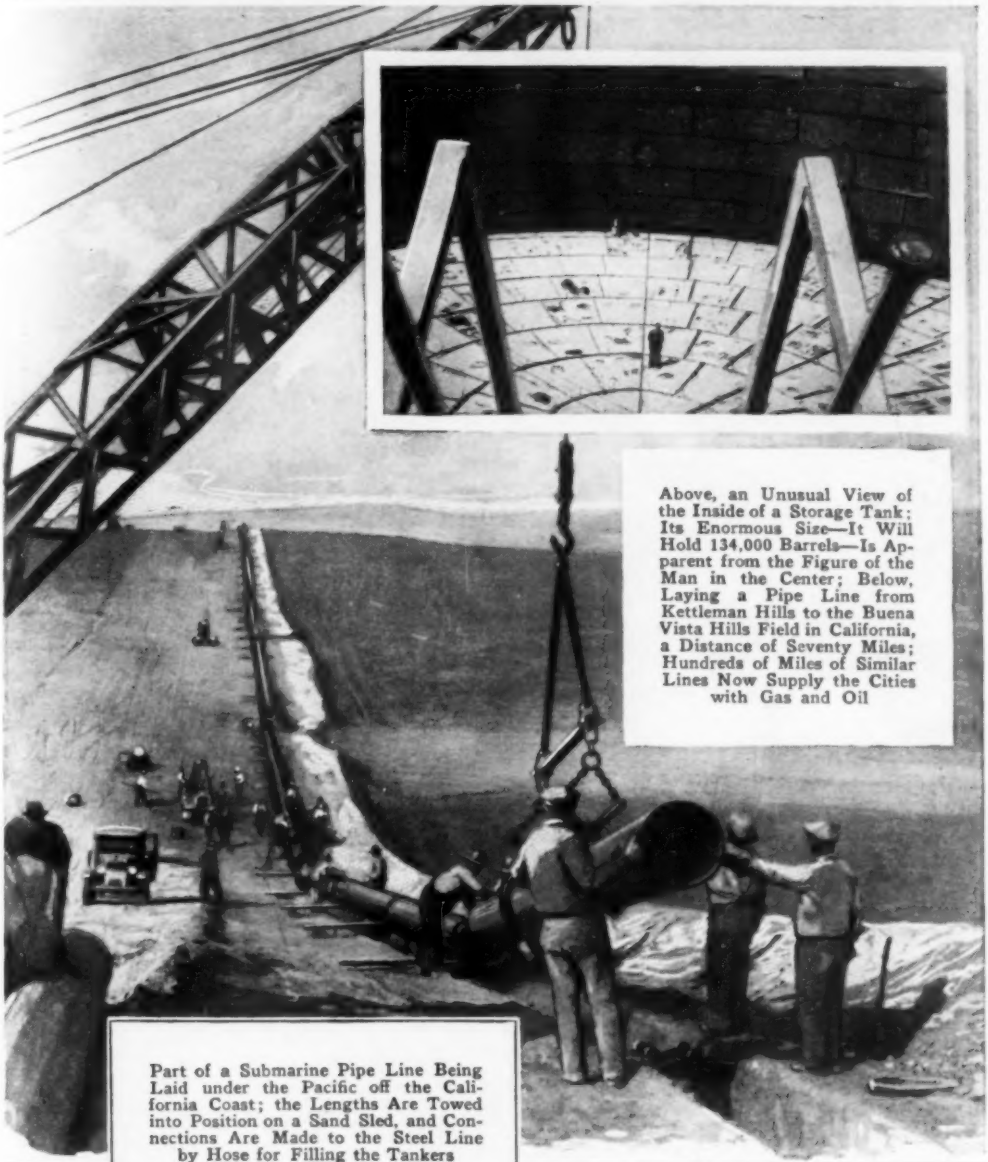
Harnessing an Oil Well and Directing Its Flow Are the Important Steps After the Drills Have Struck "Black Gold"; the Course of This Well, like That of a River, Is Being Changed by Sending It through an Underground Pipe 255 Feet from the Mouth



Huge Oil Tanker Loading in Los Angeles Harbor through Extension Pipe Line, and, Below, Fighting an Oil Fire; the Men Wear Asbestos Suits and Drag Their Lines as Near the Blazing Geyser as They Can; to Protect the Oil Fields More Adequately from Fire, Engineers Have Developed Chemical and Other Means



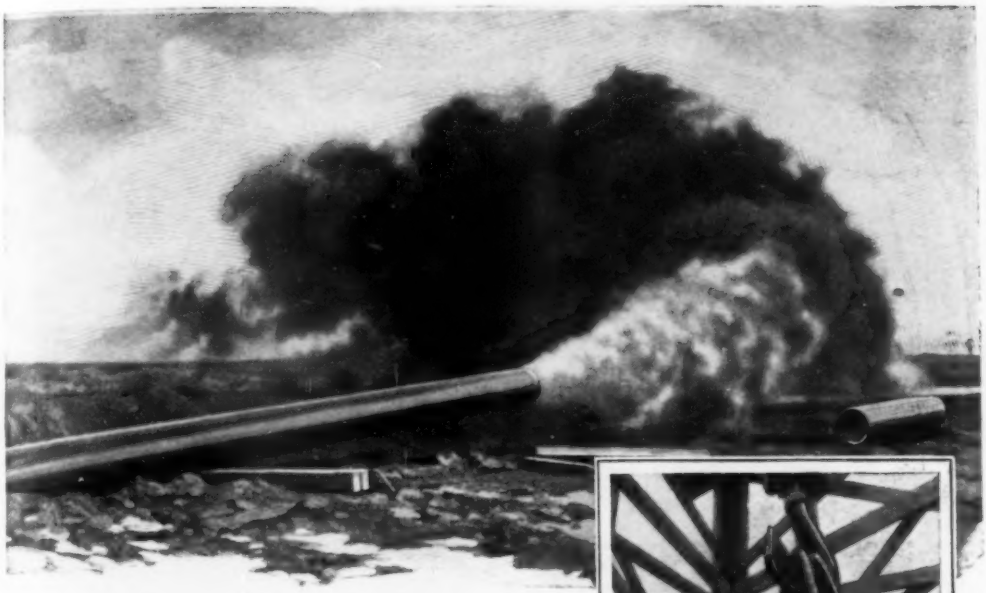
From a Roaring Deluge of Flame, an Oil Well Is Transformed to a Harmless-Looking Pipe in the Ground, as Shown Above; the Mouth of a Well That Had Blazed for More than Seven Weeks Before It Was Successfully Capped with the Fittings Illustrated; Below, a Gas Well on Fire in the Santa Fe Springs Area, California; While a Blazing Well Alone Often Means a Loss of Fortunes, the Fire Is Particularly Feared for What It May Do to the Surrounding Derricks and Buildings

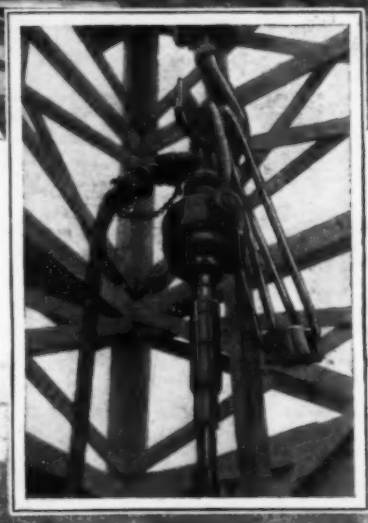


Above, an Unusual View of the Inside of a Storage Tank; Its Enormous Size—It Will Hold 134,000 Barrels—Is Apparent from the Figure of the Man in the Center; Below, Laying a Pipe Line from Kettleman Hills to the Buena Vista Hills Field in California, a Distance of Seventy Miles; Hundreds of Miles of Similar Lines Now Supply the Cities with Gas and Oil

Part of a Submarine Pipe Line Being Laid under the Pacific off the California Coast; the Lengths Are Towed into Position on a Sand Sled, and Connections Are Made to the Steel Line by Hose for Filling the Tankers

The Beauty of a Gas-Well Fire at Night May Be Enjoyed by Residents for Many Miles Around, but It Is a Nightmare for Producers and Drillers; Such a Conflagration Stops Activities in a Large Part of Any Crowded Oil Field; at Left, After a Well Is Brought In and Put on the Pump, Operators Record the Gas Pressure in the Hole to Determine the Volume of Gas and the Capacity of the Well; with a Gas Recorder Attached by a Flexible Hose to the Top of the Well, Readings Are Available at Any Time; Devices Such as These Are of Proved Value, but Their Development and Use Have Added to the Cost of the Oil-Drilling Business, One of the Most Expensive in the Entire Mining Field





After Laying a Pipe Line to Carry Natural Gas, the Crew Blows Gas down Line to Clear Out Any Obstructions, as Shown Above; at Right, Swivel, Kelley and Mud Pipe; the Swivel Holds the Square Pipe, or Kelley, Which Revolves and Also the Bit Which Drills the Hole; the Mud Hose Leads Mud through Pump Back into Hole; Below, Oil Derricks in a Residential District

Inset, Large Bits, Some Measuring More Than Two Feet Across, Are Used to Start Drilling a Deep Well; Later the Bits May Measure as Little as Two Inches as Hole Diminishes; Below, a Tank-Car Fire

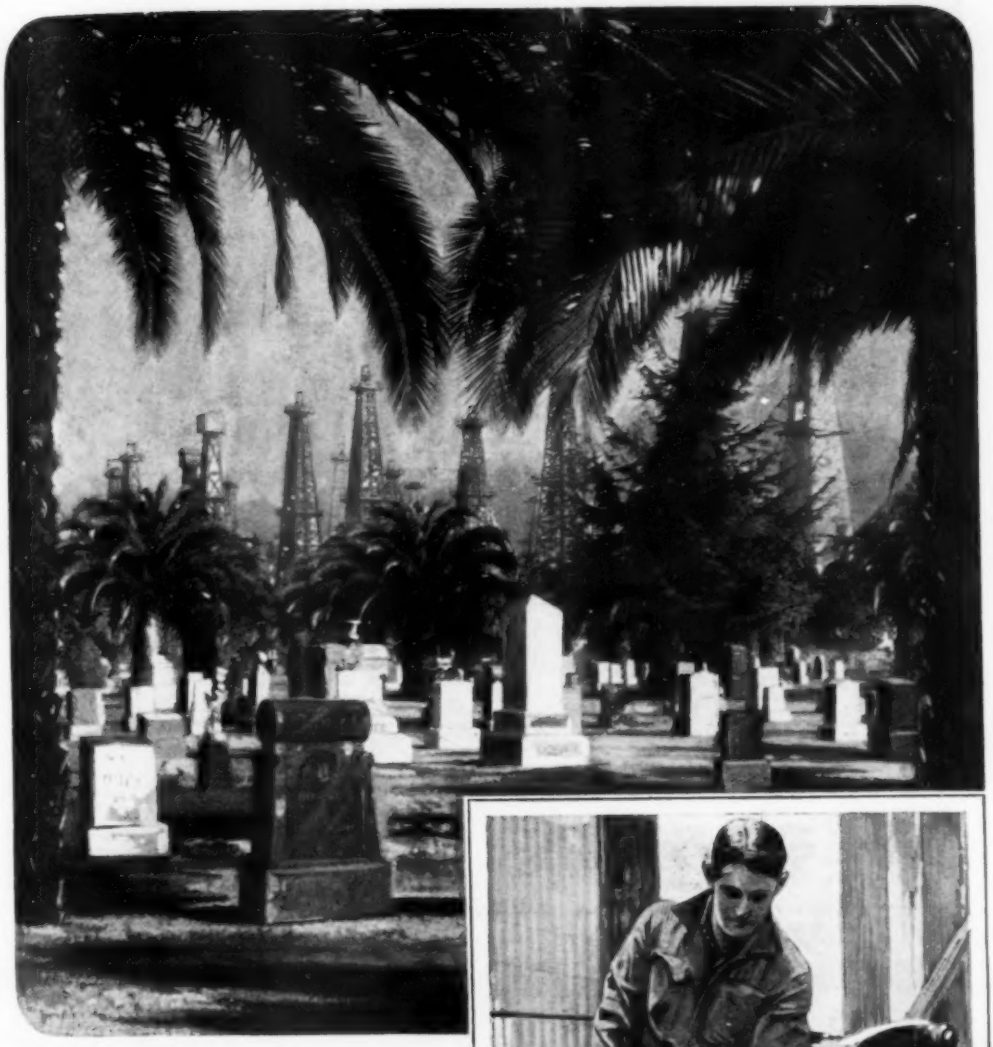
Above, Members of the Drilling Crew Are Breaking Sections as Each Length Is Pulled from the Hole; a Derrick Man Stands Above on the Platform to Stack the Pipe as It Comes from the Hole; at Left, Gas Pressure When a New Well Comes In Sometimes Shoots the Oil Hundreds of Feet into the Air; This Is a Typical Illustration of Such an Occurrence; Preparing for the Flow of Oil Is an Important Preliminary to the Completion of the Well; Temporary Sumps or Basins Are Scooped Up Out of Earth, to Catch the Flow and Save as Much as Possible, Until the Well Can Be Brought under Complete Control; a Powerful Gusher, Such as This, May Wreck the Derrick and Much of the Drilling Machinery Unless Preparations Are Made in Time

At Left, Device, Put in Small Section of Casing and Lowered into a Well, Acts as a Surveyor and Indicates by Degrees the Inclination of the Hole from the Vertical Path; the Instrument Measures Both the Inclination and Direction in Which the Well "Wanders"; Cases Are on Record in Which Wells, Drilled on Adjoining Property, Have Met Hundreds of Feet below the Surface, Requiring a Cessation of Drilling or Causing Conflict as to the Ownership of the Oil if It Is Found; Below, a Portable Foam Tower, Carried in Sections, Is One of the Latest Weapons for Fighting Fires in Oil-Tank Areas; the Tower, When Erected, Enables the Fighters to Pump Fire-Extinguishing Foam on the Surface of the Oil; the Tower May Be Erected Permanently on the Tank as Shown Here, by Fastening It with Cables and Pulleys So That It May Be Hoisted Up like a Telephone Pole When It Is Needed; Foam Has Been Found Effective in Many Blazes, as It Literally Smothers the Fire by Shutting Off the Oxygen Supply

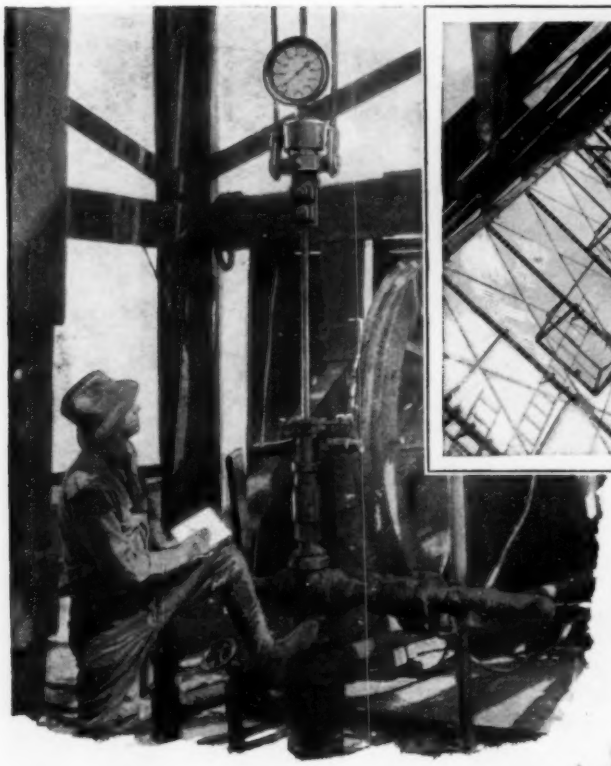
Above, Tankers Being Loaded with Oil Which Is Flowing through the Pipe Line Seen in the Foreground; the Man Directly Above Is Holding the "Mechanical Brains" of the Oil Field, the Core Bit Whose Sharp Teeth Bite Out Samples of Earth for the Oil Prospectors to Test; Below, Hauling an Oil-Line Hose aboard a Barge for Cleaning; Flexible Lengths like This Tap the Main Oil Line, for Supplying the Tankers, Loaded with a Flow That May Come from Wells Many Miles Away

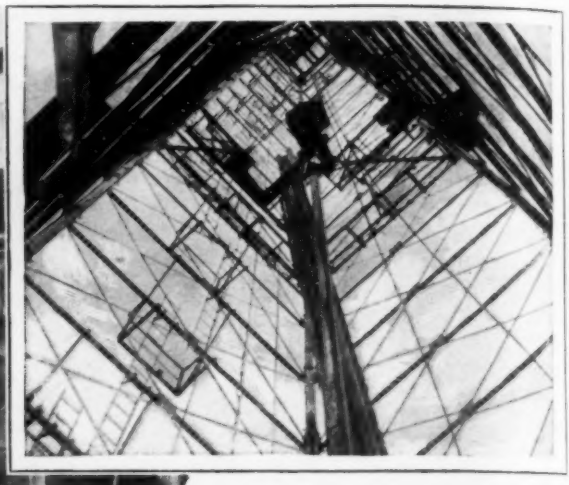
Members of a Well Gang Spinning In a Length of Drill Pipe over a New Deep-Zone Well at Santa Fe Springs, California; the Huge Tongs, Used in Tightening the Connection, Are Just Being Swung into Place; This Is One Reason Why a Deep Well Cannot Be Drilled in a Day

Where Man Has Riddled the Earth in the Search for Black Gold; View of Part of the Derricks and Tanks of a Rich Field in California



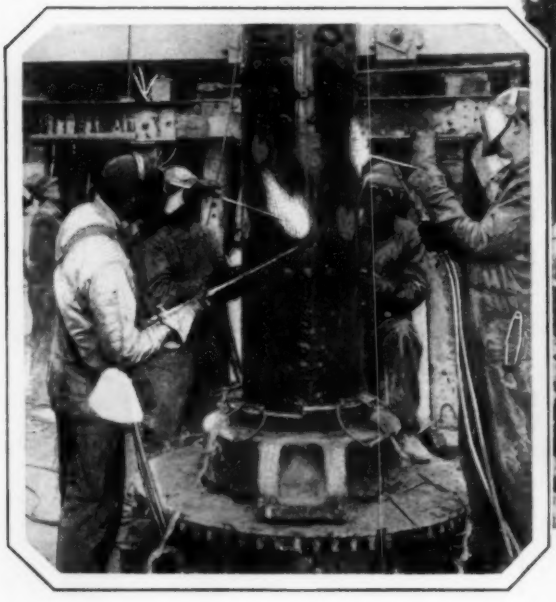
The Last Stand! Oil Wells Have Spread Out All over Famous Signal Hill, near Long Beach, California, and Now Completely Encircle the Old Cemetery and Its Beautiful Palms, Lying Halfway down Its Western Slope; at Right, Removing Core Bit from Core Barrel with a Chain Tong; the Core Bit and Barrel Are Used to Cut Out Samples at the Bottom of the Hole for Study by Geologists; the Bit Rotates and Bites a Sample Column Which Is Then Drawn Up; Scientific Prospecting Has Removed Much of the Guesswork in Hunting for Oil, the Presence of Which Can Be Detected by the Soil Formation, the Slope of the Strata and by Other Indications Easily Interpreted by the Trained Geologist; There Is Still Plenty of "Luck" in the Work; Oil May Be Found in Many Places, but Does It Exist in Sufficient Quantities to Justify Drilling and Commercial Production? Fortunes Have Been Won and Lost in Answering the Question

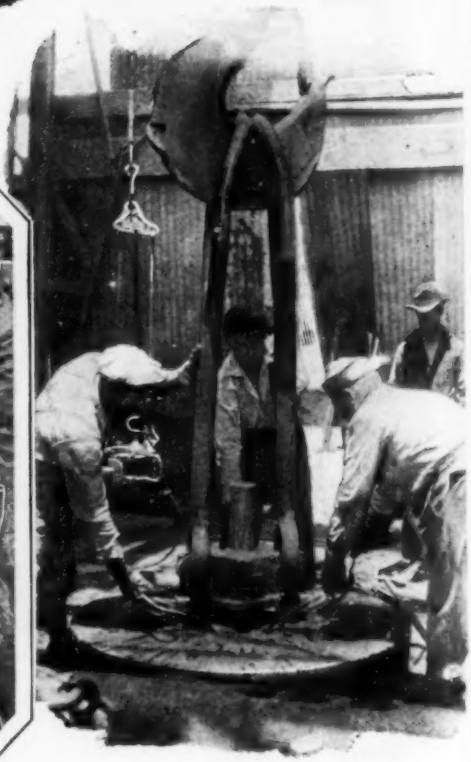




Looking Up inside One of the 120-Foot Steel Derricks Used for Deep-Zone Well Drilling at Santa Fe Springs, California; the Steel Structures Are Reinforced like Steel Skyscrapers, as They Must Support Heavy Weights; at Left, Measuring the Pull per Pound on the Pumping Rod After the Hole Has Been Completed; Pumping Becomes a Serious and Complicated Problem in Deep Wells, For Excessive Pull May Separate the Machinery

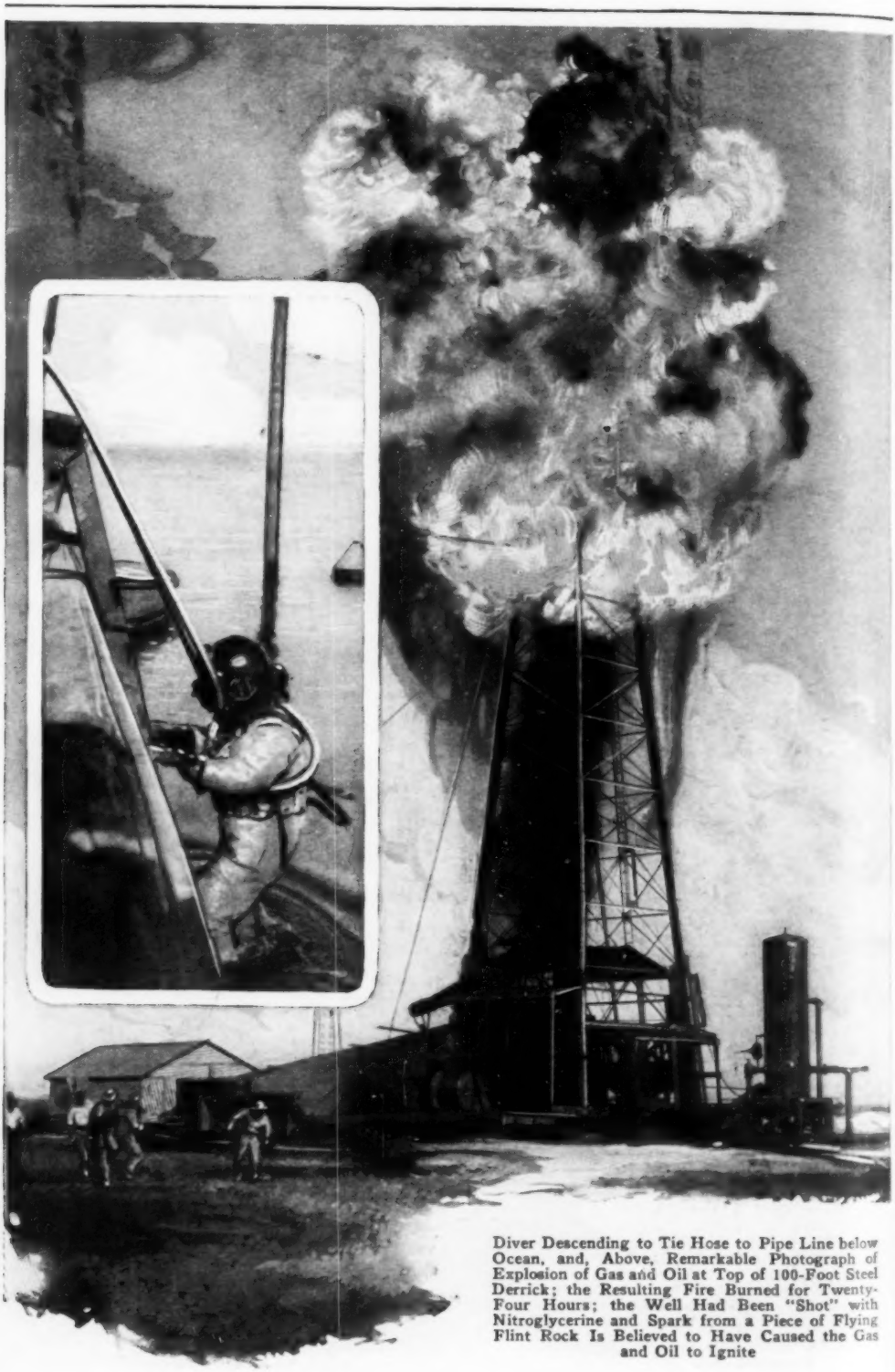
Below, Welders Riveting Twenty-Inch Stovepipe Casing before Lowering It into the Hole; This Casing Serves as a Guide for Later Drilling; at Right, Setting the Slips, the Wedges That Support the Pipe Temporarily While It Is Being Pulled Upward from the Hole





Drilling a Tunnel to a Well to Permit Capping It during a Fire; Several Outlets Were Made below the Surface to Diminish the Force of the Oil and Gas, and So Give an Opportunity for Shutting Down the Well; at Left, beneath This Derrick Is a Well of Record Depth, the Standard Mascot No. 1; It Is 9,629 Feet Deep and Required 458 Days to Drill

Members of the Drilling Crew Holding the Slips Which Wedge against the Drill Pipe, Preparatory to Joining New Lengths to It; They Are Getting Ready to Pull the Pipe; When One Stand Is Pulled, the Elevator Is Loosened and the Pipe Stacked against One Side of the Rigging; When Wells Descend More Than a Mile in Depth, as Many of Them Do, the Problem of Handling the Casing for So Deep a Hole Is an Expensive One



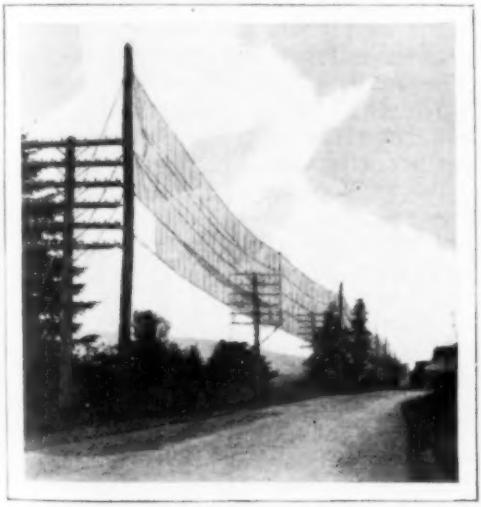
Diver Descending to Tie Hose to Pipe Line below Ocean, and, Above, Remarkable Photograph of Explosion of Gas and Oil at Top of 100-Foot Steel Derrick; the Resulting Fire Burned for Twenty-Four Hours; the Well Had Been "Shot" with Nitroglycerine and Spark from a Piece of Flying Flint Rock Is Believed to Have Caused the Gas and Oil to Ignite

PALACE ON TOP OF BIBLE CITY TO BE EXCAVATED

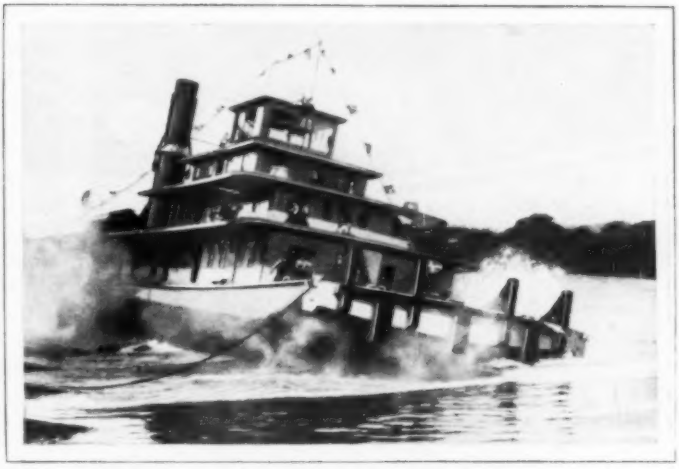
Ruins of the palace which once rose above the Canaanite royal city of Kirjath-Sepher are being excavated. The city figures in Biblical record as the town which Caleb so desired to capture from the Canaanites that he offered his daughter's hand to the Israelite who would take the stronghold. The mound which represents this historic city lies about fifty miles south of Jerusalem. Ruins of six settlements in layers one above the other, have been found in earlier expeditions. Kirjath-Sepher means "book town," but so far no library has been found.

STEEL NET GUARDS MOTORISTS FROM ROCKS IN BLAST

Traffic was not interrupted and motorists were protected during blasting along a stretch near the Columbia river highway by erecting a strong steel net between high poles beside the road to shield cars from flying rocks. The net also saved the road surface from damage.



How Steel Net on Poles Protects Motorists from Flying Rocks



The Latest Type of River Towboat at Its Successful Launching; It Is Electrically Powered

ELECTRIC-POWERED TOWBOAT TAKES TO THE RIVER

The first turbo-electric river towboat recently was launched and underwent successful tests at Charleston, W. Va. The launching afforded an opportunity for an unusual picture of the modern freight engine of the river which was snapped just as the big boat made its first mighty splash as it took the water.

WEEVIL AND WEATHER DATA FORETELL COTTON CROP

Scientists are able to predict how much cotton will be produced, months in advance, by studying weather conditions and estimating the numbers of boll weevils that have hibernated during the previous winter. The predictions are based on thousands of weather reports from the many stations in the cotton belt by a process developed during the last twenty-one years, and the weather conditions permit an estimate as to the numbers of weevils that have been produced during a summer, how many have survived the winter or have been killed because of unusual cold or dryness. In 1926, the predicted total cotton crop was about the same as the actual production. In 1921, a year of an unusually low yield, there was an error of only seven per cent in the estimate, while in 1928 the prediction was but three per cent less than the actual total.

High Water Tower to Aid in Fighting Skyscraper Fires; It Is Sixty-Five Feet High and Has Four Nozzles

TALL WATER TOWER TO FIGHT FIRES IN SKYSCRAPERS

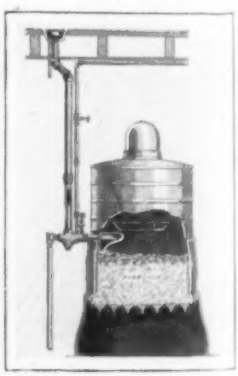
To battle fires in skyscrapers, a lofty sixty-five-foot water tower recently was tested in New York. It is equipped with four nozzles, capable of shooting 28,000 gallons of water a minute for a distance of 175 feet.

CLOUDS SPRAYED WITH DRY ICE MADE TO YIELD RAIN

After several failures, a Dutch scientist has succeeded in producing rain by throwing dry-ice powder on clouds from an airplane. The falling particles of solid carbon dioxide, used as a refrigerant, become laden with electricity, transforming them into numberless very small drops and these convert the clouds into larger drops causing them to dissolve or condense into rain. The successful experiment was conducted over the Zuyder Zee, the dry ice being sprayed on thick masses of clouds which yielded a local drizzle. Former tests had been unsuccessful because of adverse weather conditions or lack of the right kind of clouds. Scientists believe that it also will be possible to produce artificial clouds to furnish the rain by means of an ammonia or chlorine combination. Actually, however, the experiments have been conducted with a view to furnishing more sunshine rather than more rain. By throwing dry-ice powder on clouds and mist in the early morning, the sky can be cleared for the rest of the day. Fogs and frosts may be attacked in the same way.

AUTOMATIC HUMIDIFIER SUITS ANY FURNACE

Furnishing moist air at even temperature for the entire home, a humidifier made for attachment to any kind of furnace or heating plant, is entirely automatic in operation. It consists essentially of a series of pipes leading from the water supply into the furnace, through a steamer and then to a grating in the floor. The water feed is governed by a control valve, which, once set, requires no further attention. There are no moving parts to get out of order, and overflow pipes avoid any danger of damage from this source. There is only one outlet, but even distribution of humidity to all rooms is effected by convection air currents. Tests have shown that its use results in a saving of fuel.

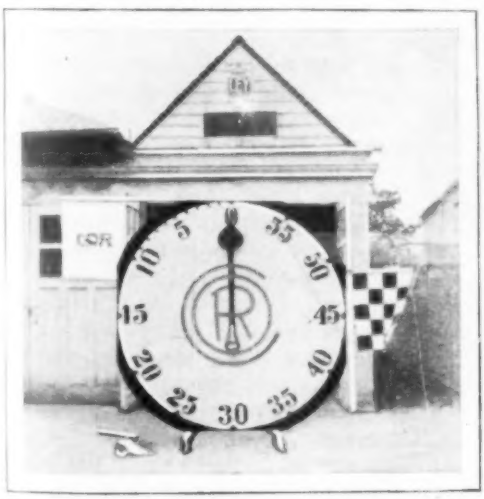


NEW JOBS FOR ELECTRICITY FOUND ON FARMS

Not content merely to substitute for mechanical and man power on the farm, electricity is finding new and exclusive ways in which it can bring to agriculture advantages of research corresponding to those enjoyed by industry. Electric lubrication of the soil to make plowing easier, treatment of ensilage so that it will keep better, the heating of hotbed soil with electricity, and putting crops under electric discharges and under ultraviolet and white light to increase yield, are subjects of recent research. Water already in the soil is the lubricant for plowing. It is drawn to the moldboard of the plow by making that the negative terminal of an electric circuit. The coulter, insulated from the framework, is the positive terminal. Field experiments show that the force required to pull the plow is reduced every time the current is turned on.

BOAT-RACE STARTING CLOCK FIRES OFF CANNON

To insure better starting of boat races, an official of an eastern outboard association has introduced an efficient clock which does three things at once. It points to the "Go" signal, dips the starting flag and fires off a cannon. The dial is about six feet in diameter, and the apparatus weighs less than seventy pounds.



Giant Clock for Boat Races Which Dips the Starting Flag and Fires the Gun

Electrically Lighted Eyeglasses Designed to Help Night Workers

ELECTRIC-LIGHT EYEGLASSES AID NIGHT WORKERS

Devised especially for persons compelled to do much reading at night, eyeglasses introduced by a German firm have electric bulbs on each end of the frame. They are supplied with current from a battery which can be carried in the pocket.

TEST WARMTH OF OVERCOATS ON REFRIGERATING COILS

How warm is your overcoat? An eastern firm is able to give an exact answer by wrapping the garment around a heating unit in a test machine, turning on the refrigerating coils, starting a fan and then reading the degree of the coat's resistance to the cold on special dials. The heating unit is held at body temperature and the amount of heat supplied to it is measured electrically. A wind velocity of twenty-five miles an hour can be created by the fan, and the coils are able to reduce the temperature to twenty degrees Fahrenheit. The measuring apparatus shows how many heat units are allowed to pass through the various kinds of cloth tested. Curly-faced overcoating passes slightly over two units every hour for every degree difference in temperature between the heat unit and the surrounding air, and Alaska seal less than two.

IT'S EASY

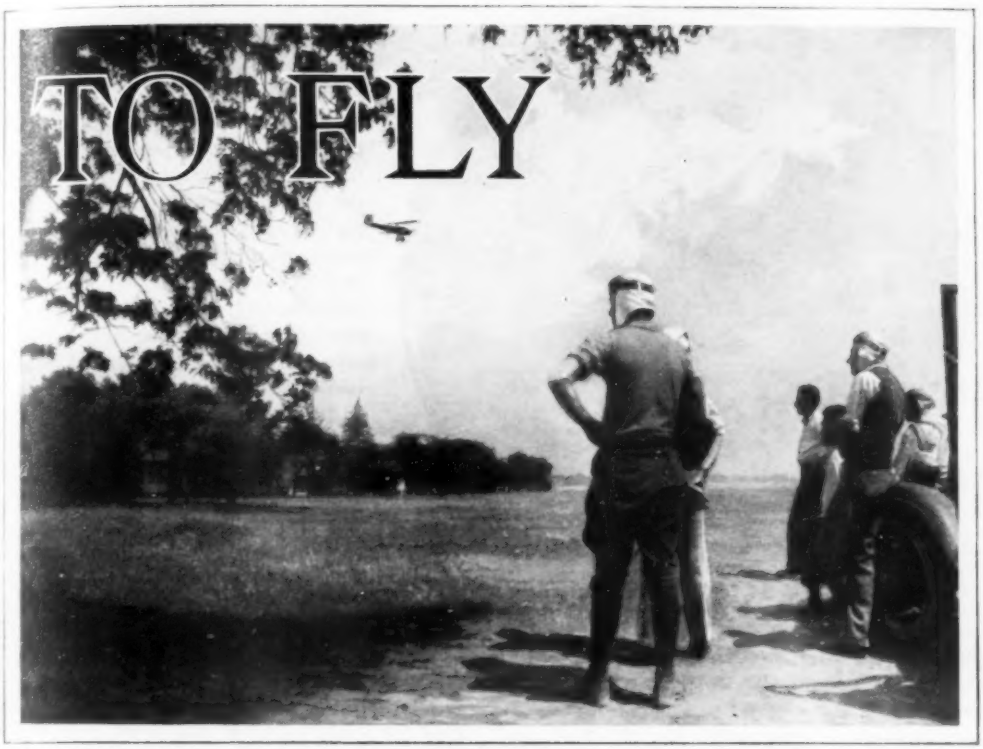
Pilot Myers Using the Speaking Tube; It's Easy to Hear Him Even above the Roar of the Motor; Below, There's a Trick to Getting into the Ship—at First

By PAUL D. PADDOCK

"I'LL take off, fly around the field once and land," said Pilot Myers. "Then I'll ask you if you're comfortable. If you are, we'll take off again, go up about 2,000 feet, and I'll let you try your hand at the controls. Now follow through and watch what happens to the nose of the plane as we take off and as we land."

I nodded, the motor barked as he advanced the throttle to taxi into the wind, and I wondered how this adventure of learning to fly would end. I am thirty-nine years old. I don't drive a car. I have possibly less than the average knowledge of motors. Of aeronautics and the airplane, I know little. Can an office man like myself, familiar chiefly with typewriters and a notebook, master the controls of a sky-speeding plane? But they say it's easy to learn to fly. Well, we'll see, I reflected as the plane lifted on this, the start of twenty hours in the skies to win a private pilot's license.

Lifebelt snugly fastened about the waist. Right hand on the stick, held gently between the thumb and first two fingers. Feet on the rudder pedals. Parachute



Students, Instructors and Others Are Interested Observers during a Department of Commerce Test for Licenses, When Candidates Must Satisfy the Inspector That They Have Mastered the Course

snugly, but not too tightly, buckled and forming a comfortable cushion in the seat, which can be raised or lowered until you can just see the tips of the top engine-valve covers over the nose of the plane.

Sit easily and relax. Enjoy yourself! Don't grow tense. How valuable that advice proved and how much it helps in learning to fly. Wear comfortable clothing, especially an easy pair of shoes. You cannot fly well if your feet hurt.

Learning to fly today is a progressive process of trying to do exactly as you are told, using your senses and keeping both mind and body relaxed although instantly obedient. It's keenly interesting, it's great sport as well as a profound and absorbing study.

The plane stops. It is now facing squarely into the wind, the proper position for a take-off. Myers advances the throttle all the way forward. That's "giving it the gun." With a mighty roar, the engine responds. The ship moves. As it starts, the pilot puts the stick far forward. That moves the elevator at the rear of the plane and brings the tail up and off the ground so that we can gain speed more quickly. The brown dirt of the landing field goes blurring by and I can feel Myers kicking the rudder pedals, first this one and now that, to keep the plane going straight ahead. Remember that rudder. It's the most important part of the take-off. Back comes the stick, easily and slowly of its own accord, and, before I realize it, the crunching and bouncing of the landing wheels have stopped and we are in the air.

Full throttle for the take-off and the initial climb, but when we have reached a height of 500 feet or so, Myers eases back on the throttle until the tachometer shows the propeller speed to be about 1,500 revolutions per minute, the proper speed for cruising, and as we level off for straight flying, the nose of the ship comes down on the horizon. A gentle turn, and we are gliding down for the landing.

"We start our glide at the proper distance for making the field," says Myers through the speaking tube. I can hear him plainly now, for he throttled the en-

A Good Way to Hold the Stick, Lightly, between the Thumb and First Two Fingers Only, to Keep from Grasping It

gine down to make the glide, and about the only noise is the musical whine of the wind through the wires. "When we are about thirty feet above the ground and over the field, we start to slow down like this." He moved the stick back gently, a mere fraction of an inch. The nose of the plane came up slightly and we were flying level. The speed slackened and the ship settled perceptibly. "We're sinking a bit; feel it?" Myers continued. "Every time we feel the ship sink, we pull back a bit more on the stick. So. A little more, more, and now all the way back!" As he spoke, the "Fledgling" softly floated down on three points, both wheels and the tail skid simultaneously—a perfect landing—and we rolled to a gentle stop.

Then he gave me one of my first and most important warnings. "I told you to follow through with your hands on the controls," he said. "That was all right. But on that landing you were pushing against the stick, weren't you? I could feel you opposing me. Never do that. Don't grasp the stick tightly and don't ever try to exert pressure on the controls when the instructor has them."

Instinctively, as the ground was coming up to meet us on the landing, I had been pushing on the stick. The wrong way too; a sort of blind effort to keep the ground from coming up, but from that moment on, I always tried to handle the stick as though it were an eggshell.

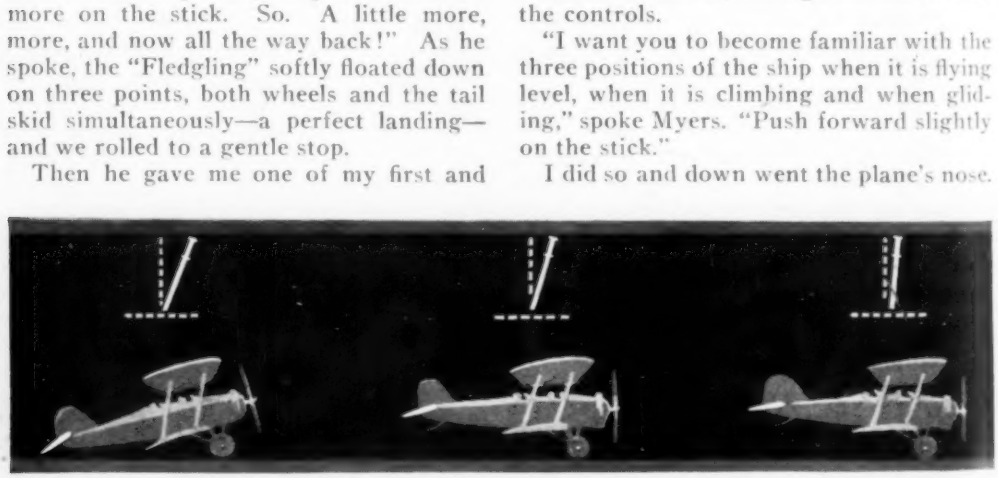
Again we wheeled into the wind and soon were climbing for the next and last part of this absorbing lesson.

"I want you to get acquainted with the country around here," said Myers, when we had gained 500 feet or so of altitude and he had throttled the engine down to cruising speed. "There's our field just below us. The golfcourse is at the right, and over there's the lake. Take a good look around. It will help you in keeping your bearings."

Suddenly the stick shook briskly, the signal for attention. Myers jerked his thumb back at me, the sign for me to take the controls.

"I want you to become familiar with the three positions of the ship when it is flying level, when it is climbing and when gliding," spoke Myers. "Push forward slightly on the stick."

I did so and down went the plane's nose.



Drawings Copyright

Sketch of Take-Off Positions with Diagram of Stick Movements; Far Forward as the Plane Starts, Then Back Gradually of Its Own Accord as Plane Gathers Speed

"Pull back a little," was the next command. I obeyed but overcontrolled. Up shot our plane at a steep angle that seemed to verge on a stall, but Myers firmly and quickly corrected my blunder and we were flying level again.

"You're holding the stick too tight," he cautioned. "Don't squeeze it and don't move it so fast or so far. Take it easy."

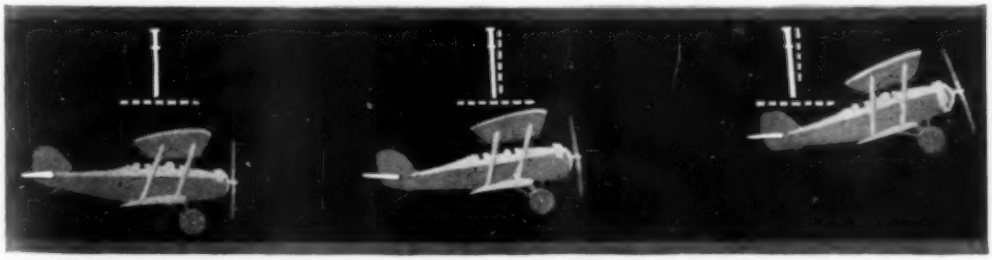
I pulled back gently at the next order and we climbed gently. Back to neutral again and then forward a bit for a glide position. How easy it was. No work at all. The "Fledgling" weighed more than a ton, but I could have maneuvered the stick with a little finger that day.

"Notice, in level position, that the nose of the plane is right on the horizon," said Myers. "Take a look at the wings. They should be level with respect to the horizon, parallel to it. You can see some sky and some land between the wings, about half of each. Remember, the horizon is your guiding line at all times. In level flying, the nose of the plane should be right on that mark."

Your Parachute Should Be Comfortably but Correctly Adjusted, Pilot Anderson Cautions; He Holds the Ring in His Left Hand

Before climbing out of the ship, you go over every detail of the lesson with the instructor, a practice followed after every hop. Then you walk back to the school office, glowing as though you had had a shower bath and a rub-down. Twenty minutes in the skies, at a speed of eighty miles an hour or so, have set the blood tingling and the mind working.

Before this first lesson, I had taken the important step that every candidate for a flying license must take, the physical examination. Dr. W. P. MacCracken, one of the physicians delegated by the department of commerce to examine pilots and candidates for student permits, gave me a general health, eye and ear examination and explained that the tests for a private pilot's license are essentially the same as for the other grades of licenses, except that they are not so rigid as to the passing grade. You are asked to stand on one foot, close your eyes and raise the other foot without losing your balance, walk backward with your eyes closed and "drive the ponies." This is an interesting test of depth perception, the idea being to stand at twenty feet and, with cords, try to pull a movable perpendicular bar, adjusted inside a small cabinet with an opening at one end, until it appears to be exactly opposite a stationary bar of the same height and size. You are asked questions



The Standard Oil Co.

Further Positions in the Take-Off; Three Stages of the Initial Climb with the Stick Slightly Back; Note Positions of Elevator at Rear of Plane

Where the "Kiwis," the Student Beginners, Settle Aviation Problems While Waiting Their Turn for a Hop; Watching a Fellow Student Land

about your disposition, what you like and dislike, and if you lose your temper easily. All these questions reveal facts important to the business of flying and are calculated to reveal any fundamental defect that might interfere with your progress.

"You're likely to think that the ground is closer than it is when you're landing," Doctor MacCracken told me after my eye and depth-perception tests. "You may have a tendency, for that reason, to 'pancake' in or land too hard. Watch out for that." I had passed the examination by a safe margin, but was glad of this extra bit of caution, and the doctor's prophecy proved correct, although I had little trouble when I found out where to look when landing.

From the first flying lesson, the work progressed in short, twenty or thirty-minute sessions to turns and banks, practice on take-offs and landings, "cutting patterns" around the field each time; that is, flying a prescribed course with turns at the proper points and, as a thrilling interlude to the general program, an introduction to stalls and spins.

On banks and turns, the problem is to start the ship around in the desired direction with the rudder, at the same time using the stick to bank the plane, that is, tip the wings at the proper angle to prevent skidding. The trick on the turns is to apply the proper amount of rudder and stick and to synchronize the two.

To make a left turn you move the stick to the left and apply left rudder, that is move the left rudder pedal forward at the same time. Moving the stick sideways changes the position of the ailerons and thus tips your wings. For a left turn, for instance, you want the left wing inclined downward and the right wing upward, providing a bank. Moving the stick sideways to the left accomplishes this. Press left rudder at the same time and you turn to the left. To recover and fly straight again, rudder and stick are moved to the right, that is, right rudder is pressed

To Climb, You Pull Back on the Stick; the Movement Lifts the Elevator as Sketch Shows, Causing the Nose of the Plane to Rise; a Slight Pull Is Usually Enough

forward and the stick brought back to the right until the wings are level once more. The movements must be synchronized and the proper amount of each control administered. Another tendency gives most beginners troubles with banks and turns. There is some difficulty in keeping the nose of the ship on the horizon. In moving the stick to the side, there is a likelihood of pulling it back or pushing it forward at the same time, resulting in a climb or a dive with loss of altitude. Skidding announces itself by a blast of air on the side of the face on the outside of the turn.

With every lesson, I was given additional work on take-offs and landings. There was a big thrill in taking the ship off alone, but before I managed a successful take-off, I made the serious mistake of kicking the wrong rudder pedal once or twice. Before it has acquired flying speed, the ship steers clumsily. In other words, the rudder must be moved hard and quickly on the take-off to get response. If the ship noses to the right, kick left rudder. If it noses to the left, apply right rudder. Aim at a tree or some other object and steer straight for it, taking care not to let the plane begin to swerve any great extent, in order to prevent its getting out of control.

Wrong application of the rudder on the take-off might spell disaster. It would send the plane around into a turn, one wing might strike and an upset would be the probable result. The stick is comparatively easy to manage after it has been put forward at the start to get the tail off the ground. It comes back naturally and the "Fledgling" will fly itself off the ground so there's not so much to worry about as to when to pull back on the stick for the climb. But the rudder is the important problem. Ships will fly themselves off, providing they're steered properly.

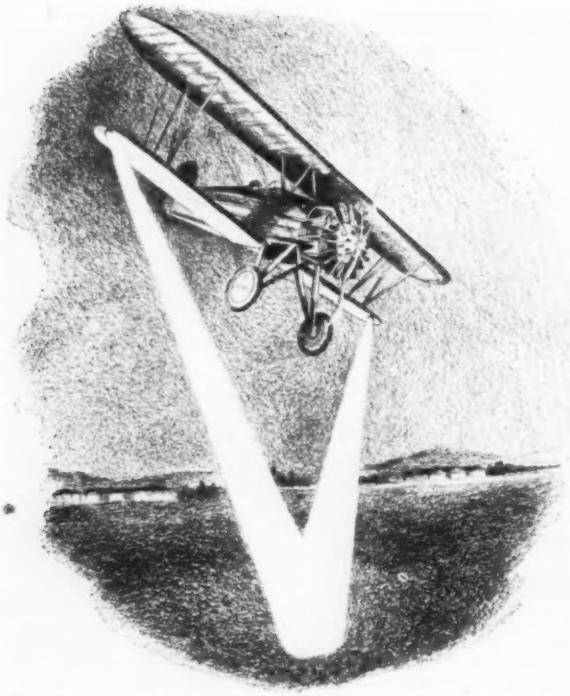
Every Word from Your Instructor Counts; Ask Him Every Question That Enters Your Mind; He Is Glad to Help You

"It's too bumpy for take-offs and landings," said Myers one breezy afternoon. "I think we'd better fly up a little better than 2,000 feet or so and do some stalls and spins."

He looked at me keenly and grinned. I had been expecting them. Here they were. What would they be like?

(To Be Continued)

Here the Stick Is Being Moved Forward to Descend as in a Glide; the Elevator Is Lowered as Shown, Tipping the Nose of the Plane Downward



Lighted Triangle Which Enables Pilot to Tell Exact Distance His Plane Is above the Ground

LIGHTS ON WINGS SHOW PILOT HEIGHT FROM GROUND

To aid the pilot of an airplane in landing at night on an unlighted field, some British ships are equipped with small searchlights beneath each wing tip. The beams from the lights converge at a distance under the plane which is known to the pilot. As the large patch of light formed by the beams crossing each other strikes the surface, the flyer immediately has visual proof of his height from the ground and governs the ship accordingly.

SHORT-WAVE RADIO CURRENT MAY FIRE BIG GUN

Short-wave radio sets aboard navy ships, and elsewhere, are a potential fire hazard, scientists have discovered, and special means have been devised to counteract the danger. Engineers have found that a fourteen-inch gun might be fired prematurely by waves from an antenna near an exposed gun, which acts as a receiver, building up sufficient current to light an electric lamp under extreme test conditions within the turret. Since the guns are fired electrically, such induced current might reach the firing circuit, resulting in a premature discharge and disaster. Radio engineers, however, have developed ways for obviating this danger. In the same way, high-frequency radio currents might set up currents in gasoline-filling hose, giving rise to a spark that might explode vapor present. Merchant vessels have been warned to guard against this danger when refueling. The hazard also exists in the air. By induction in the wires of the firing circuit of wing-tip airplane flares, sufficient current can be picked up from a radio antenna to set off the primers and ignite the flares accidentally, engineers declare.

GLASS-BOTTOMED BOAT CRAWLS ON LAND

To carry as many as ninety persons to and from excursions near an Oregon resort, a boat with a glass bottom, that permits a view of the sea to a depth of more than sixty feet, has an endless-tread arrangement whereby the craft can crawl on land, for launching and beaching. Lights are placed around the glass bottom to help attract fish and also to give a better view.

Boat with Glass Bottom for Under-Sea View and How It Crawls on Ground

WILL THE STEAM AUTOMOBILE EVER COME BACK?

A steam automobile a quarter of a century old did a little cross-country touring the other day, and performed as well as many a gasoline vehicle it passed on the road. Those who saw it asked themselves a question that has occurred at least once to every motorist: Will the steam car ever stage a come-back? Steam has been defeated hopelessly by internal combustion in the passenger-car field, but it might regain some of its lost popularity in commercial work—driving trucks, busses and perhaps tractors. That is the opinion of Arthur Scaife, vice-president of the Society of Automotive Engineers, and one of the "old-timers" in the steam-car game.

Early Steam Cars and a Truck; While Development of the Gasoline Engine Has Placed Steam Far in the Background, Some Engineers Believe It May Return for Driving Automobiles, and Airplanes as Well

"The steam automobile owes its fall in popularity to the introduction of the electric starter for gasoline cars," Scaife said. "It will never come back as a pleasure vehicle. The gasoline car has too great a start. The fact that the steamer requires a few minutes before it can operate, and that it cannot be stored in winter except in heated garages, will keep it from becoming popular. Even if the steamer owner does drain his boiler and steam lines to prevent trouble, the engine packing will freeze so tightly that no amount of pressure would break the seal.

"Steam busses and trucks, however, present greater opportunities to those who are willing to develop them. The few minutes of time required to get up steam, and the freezing hazard are of little importance in bus or truck operation. Usually, such vehicles are operated over long periods each day, and are stored in heated garages during inactive hours.

"Consider the steam bus. It possesses numerous advantages over other types. It gives off no offensive odor or dangerous fumes, is quiet in operation, is much easier to start and stop, and can be operated economically. In winter, the exhaust steam can be run through the passenger compartment where it provides all the heat necessary."

The secret of the steamer's success was the flash boiler, invented by Rollin H. White. It consisted of a series of seamless steel-tubing coils beneath which a gasoline fire burned. Water entered at the top, was converted into steam about halfway down, and superheated at the bottom. Such a steam generator is safe. If it should

explode, there would be merely a split tube and a little steam released—not enough to injure the occupants of the car.

Steam at about 450 pounds' pressure went to a two-cylinder compound engine which, when compared with present-day gasoline power plants, ran as smoothly as a straight or V-type eight. Steam was condensed and the water returned to the boiler. The car could run fifty miles on one filling of gas and water.

Speaking of speed, no one knows exactly how fast a steam-powered automobile can travel. Of all the steamers that have been used, none have failed to show a power reserve when the driver opened them up as far as his nerve would permit.

Steam presents a possible form of power for aircraft, Scaife believes; although he thinks that the fire danger might be too great. The necessity of operating a steam generator at very high temperatures is not desirable. Still, with fuel oils, the problem is by no means hopeless. Welded boiler joints, improved burners and piston valves lend weight to the belief that the steam age is not yet over.

If gasoline ever becomes scarce, the oil-burning steamer and the Diesel engine may vie for leadership in the industrial motor-transport field. The Diesel or semi-Diesel undoubtedly will be the passenger-car power plant of that day.

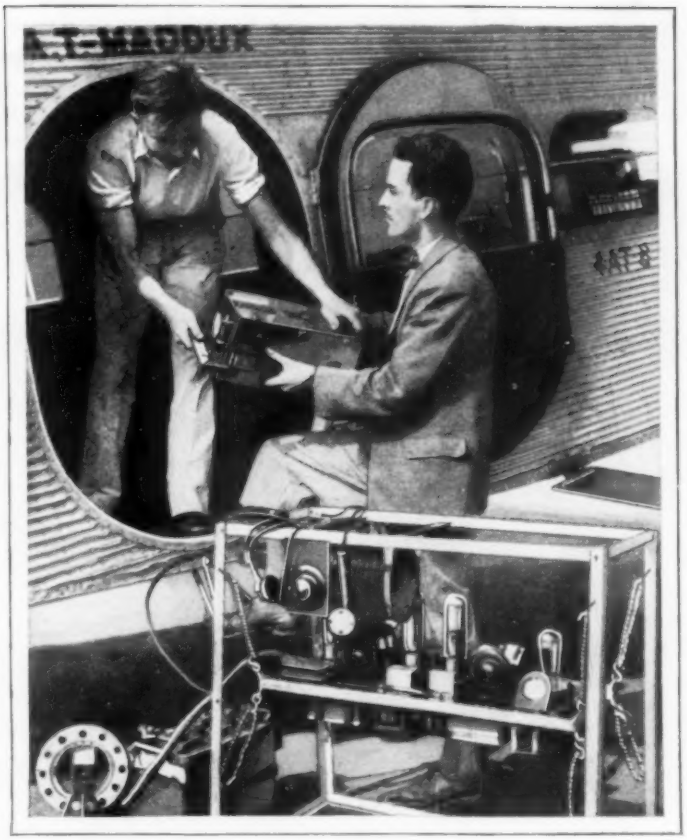
"PORT ARMS" THROUGH THE AGES FEATURE OF ARMY SHOW

One of the interesting features of the army show in Chicago recently was a display of the uniforms worn by soldiers of all this country's wars, and a demonstration of some of the changes in the manual of arms as represented in the different periods. The "port arms" position, for instance, changed with each war from the Revolution to the world war, although the change was not very marked for the Mexican and Civil war periods. Until after the Civil war, the position was known as "support arms."

Changing Styles in Army Uniforms and Way of Doing "Port Arms" from Revolutionary Days to World War; Until After the Civil War, the Position Was Known as "Support Arms"

"HOT ICE" MADE BY HIGH PRESSURE

By using pressures as high as 290 tons to the square inch, the highest artificial compressions ever created by man, Dr. P. W. Bridgman, of Harvard, has caused gases to become as dense as liquids, produced a paradoxical substance, "hot ice" and performed other interesting experiments suggesting the ancient dream of a "philosopher's stone" that would change one substance into another. At pressures greater than 29,000 pounds to the square inch, ordinary ice became unstable and was replaced by other forms, one of which became stable at 290,000 pounds' pressure and had a temperature of 180 degrees Fahrenheit—a sort of "hot ice." High pressure also produced a new form of phosphorus. It looked like ordinary graphite and proved to be a conductor of electricity. It was quite stable in the ordinary atmosphere. The extreme pressures drove the atoms of the substances closer together, apparently, Doctor Bridgman concluded.



Improved Radio-Telephone Set for Flyers Enables Pilots to Keep in Touch with All Stations and Dispatchers

"PHONY" DISEASE OF PEACHES TO BE STUDIED

The government has begun war against the "phony" disease of peaches in Georgia. Phony peach trees, originally called "pony" trees because of their dwarf size, crop up in mysterious fashion. The disease appears to be associated with the roots, for grafts taken from diseased trees and set upon healthy roots produce healthy trees, whereas buds from healthy trees grafted on phony stock produce phony top growth. It has not spread beyond Georgia so far, but it is very serious and extension of its territory is much feared.

BLOCK SYSTEM FOR AIRPLANES RUN BY RADIO TELEPHONE

Transport airplanes now may be operated on a block-signal system comparable with that by which railroad trains are run, except that the aerial dispatcher uses the radio telephone where the train dispatcher uses the telegraph or visible signals. Some of the transports now are equipped with radiophone sets by which the pilot can be in instant communication with any station in his division. This enables airplane dispatchers to keep in constant touch with every ship in the air. The development was made possible by a long-range lightweight telephone set suitable for planes and, through it, the pilot is enabled to check up each quarter hour on his position, receive the latest weather reports and other useful information.

To Conquer KANC

LEATHER HELMET OVER WOOLEN CAP
DARK GOGGLES
WIND-PROOF GLOVES OVER WOOLEN GLOVES
SEVERAL SUITS OF WOOLEN UNDERWEAR
SOLES OF BOOTS: LAYERS OF RUBBER FELT AND LEATHER
EQUIPMENT OF CHIEF CLIMBERS
STOPPED AT 24,600 FEET
THREE WEEKS IN CLIMBING ICE CLIFF 2300 FEET HIGH
21,000 FEET HIGHEST POINT REACHED BY SWISS IN 1903
ROUTE OF BAVARIANS IN 1929
AVALANCHES MAY DESTROY THE CLIMBERS
15,000-FOOT SLOPE OF ICE AND ROCK TO BE SCALED TO REACH NORTH RIDGE
AVALANCHE MAY MAY FORCE PARTY TO TRY WEST RIDGE-A LONGER DISTANCE TO CLIMB
TERRACE I
ICE WALL TO BE TUNNELED TO REACH "TERRACE I"
2 DAYS TO CLIMB 30 FEET!
CAMP 2
SUPPORTING PARTY CARRIES FOOD-SUPPLIES AND FUEL TO MELT SNOW FOR WATER TO RELIEVE INTENSE THIRST
ADVANCE CAMP I
ADVANCE CLIMBERS TO ATTACK SUMMIT
TENTS HOLD IMPROVED SLEEPING BAGS, FLOOR COVERING, OXYGEN APPARATUS AND A PHONOGRAPH IS USED TO ADD CHEER.
BASE CAMP ON KANCHANJANGA GLACIER, ALTITUDE 17,000 FEET, WHERE PREPARATIONS FOR FINAL ASSAULT ON SUMMIT ARE MADE; CAMP ESTABLISHED APRIL 26

Artist's Sketch of the Scene Where Explorers Recently Attempted Another Ascent of the Second Highest Mountain in the World, but Were Turned Back by Avalanches and Blizzards; the Expedition Was Led by Prof. Gunther Dyrenfurth, Professor of Geology at Zurich and a Famous Mountain Climber with More Than 700 Difficult Peaks to His Credit; Although the Party Failed to Reach the Summit, Valuable Knowledge of Glacier and Other Conditions Was Obtained in the Attempt

380 PORTERS

This Peak, Second Only to Mt. Everest in Altitude, Has Unusually Severe Hazards about the Base, as Shown by the Accompanying Diagram; Terraces That Are Scaled with Great Difficulty, Avalanches and Projecting Ice and Rock Test the Skill of the Climbers Long Before They Have Reached the Upper Heights; Note Altitudes Reached by Previous Expeditions

ALTITUDE-28,146 FEET; TEMPERATURE-55° (MINUS)
FINAL 1,000 FEET TO VICTORY; OXYGEN SUPPLY ABOUT ½ THAT AT SEA LEVEL
HANJANGA
Second Highest Mountain in the World
CAMP 5 ON UPPER TERRACE
CAMPS HERE IF NORTH RIDGE IS REACHED
NORTH RIDGE-ONE OF CHIEF HOPES OF PARTY TO REACH TOP
CAMP 4
TERRACE 2
THE VIOLENT MONSOON COMING IN JUNE THREATENS DEFEAT AND DISASTER
TO DARJEELING-FIRST BASE OF EXPEDITION-87 MILES FROM KANCHANJANGA
KANGLA PASS 18,200 FEET HIGH
TO WEST RIDGE
NORTH SIDE OF MOUNTAIN MOST ACCESSIBLE; NO RECOGNIZED ROUTE TO THE TOP
COURSE OF EXPEDITION FROM DARJEELING TO BASE CAMP
TSERAM INTERMEDIATE BASE
18 DAYS REQUIRED FOR PORTERS TO CARRY FOOD AND SUPPLIES FROM TSERAM TO BASE CAMP; COUNTRY TOO DIFFICULT FOR YAKS OR PONIES
DISTANCE-18 MILES
KANCHANJANGA-28,146 FEET (SURVEY OF INDIA)
ACONCAGUA-ANDES 22,834 FEET
MT. MCKINLEY 20,300 FEET
MT. BLANC 15,781 FEET
MT. WHITNEY U.S.A. 14,496 FEET

TROPICAL HELMETS AND BEARDS WORN AS PROTECTION IN THE WARM VALLEYS APPROACHING KANCHANJANGA

Successive Camps Were to Have Been Established at the Points Indicated, Preparatory to the Final Climb up the Last 1,000 Feet, Where a Temperature of Fifty Degrees below Zero and a Vastly Depleted Natural Oxygen Supply Would Have Been Encountered

Note the Drawing at Left, Showing the Comparative Heights of Kanchanjanga and Other Famous Mountains; Mt. Whitney Seems a Dwarf in the Shadow of This Mighty Peak; the Expedition Met Hard Work from the Start as Indicated by the Eighteen-Mile Trip in Eighteen Days

FRAUDULENT PAINTINGS FOUND WITH ELECTRIC RAYS

© S. K. S. News

Examining Suspected Painting Under Electric Rays to Reveal Fraud

Frauds in old paintings can be detected by electric rays under a system recently devised by Robert Maurer, Austrian scientist. The rays are able to differentiate between the genuine old masters and those that have been altered or faked. The light used is known as the "Oub ray." Maurer is a member of the Academy of Science at Vienna, and is the head of its laboratory for research on art.

GLOWING INK OFFERS GUARD AGAINST FORGERIES

Added to ordinary ink, a few drops of a chemical solution causes the ink to glow when it is examined under ultraviolet rays. Use of the material and the special ultraviolet microscope would simplify the detection of fake signatures and would reduce the losses by forgeries, according to Dr. August J. Pacini, Chicago chemist, who has made considerable research in this field. The ultraviolet rays are now being used extensively in crime detection, he points out, as they may reveal differences in the fluorescent qualities of different kinds of ink, and so indicate that a document, for instance, has been prepared under unusual circumstances or possibly deliberately altered. The rays are also employed to bring out secret messages that may have been written in ink which is invisible in ordinary light. Not long ago, the ultraviolet-ray microscope aided in the solution of a crime. Three persons were under suspicion of murder, and the chief clue was a strand of hair, supposed to have come from the head of one of the suspects. The hair was finally identified as that of the guilty man by means of ultraviolet rays. The prisoner had been an addict to a certain drug, which affected his hair in such a way that it glowed under the rays while ordinary hair does not.

BULLET-PROOF CAR FOR POLICE HAS ARMORED FRONT

Several hundred features, including a bullet-proof front section, are included in a high-speed car recently built especially for police work. The windshield and wings of the touring car are of laminated bullet-proof glass more than an inch in thickness. In the windshield is a gunport with a rubber liner for steadying the weapon. The windshield frame contains a steel lining and over the front end of the car is a sheet-metal guard, while metal guards also protect the front tires, and special lamps, built into the bumper, are safe from gunfire. The car has a 133-horsepower engine capable of developing ninety miles an hour, and is equipped with a radiator-cooled oil system.

New Armored Police Car with Bullet-Proof Front Which Protects the Radiator and Similar Guards for the Front-Wheel Tires

RAILWAY HAS "NAVY" OF MANY BOATS

Recent compilation of the equipment of the Pennsylvania system shows that this railroad owns and operates a veritable navy. Its floating equipment includes thirteen ferryboats, forty-five tugs, 159 barges and 105 car floats. Other railroads are turning to the sea for names for their trains and cars. The New York, New Haven and Hartford has named a train running between New York and Boston "The Yankee Clipper," and the cars are named after famous American clipper ships with paintings of such vessels hung in the cars.

FUEL GAS FOR RURAL USE DELIVERED IN TANKS

Liquefied propane, an industrial-gas preparation, is now available to rural consumers who have no access to domestic gas lines. It is delivered, under pressure up to ninety pounds, in portable steel tanks, ready to be connected to the kitchen stove. Propane is extracted from petroleum in liquid form and is a single chemical substance, and not a mixture of substances as is the case with gasoline, benzine or kerosene. For some years, there has been a trade in a very volatile mixed fuel extracted from "wet" natural gas. This product contained propane, which boils at forty-nine degrees below zero, and other substances of higher boiling points.

LONG-DISTANCE RADIO BOTTLED ON PHONOGRAPH RECORD

During recent experiments in which Senator Marconi, the inventor, carried on communication with Sydney, Australia, from his yacht anchored near Genoa, Italy, a message from Marconi coming over 11,000 miles of space was recorded on a phonograph record at Sydney, and later retransmitted to the sender. The test led to a discussion of the feasibility of "bottling" important radio programs in like manner for rebroadcasting.

Top Three Stories of the Drake Apartments, Chicago, Shown Here, Constitute a Private Dwelling

HOUSE ON TOP OF SKYSCRAPER HAS TWO YARDS

More than 300 feet above the sidewalk, a three-story, nine-room house occupies the top of a skyscraper apartment building in Chicago. It has a front and back yard, formed by the terraces of the stories below. Each yard is approximately 120 square feet in area. The house is roofed with aluminum shingles, and the walls are of brick and stone. The large chimney at the top, into which the fireplaces of the residence open, also serves the building.

PINE SEEDS SPROUT ON ICE

Chilling on ice hurries the germination of the large, edible-nut pines regardless of their native habitats, experiments at the University of Southern California have disclosed. Tests with different varieties of these seeds showed that some species required from twenty-five to thirty days' chilling, while others needed up to fifty or sixty days for best germination.

The World's Queerest

Sculptors Find Jobs in Motion-Picture Studios, Designing and Executing Clay Figures Used in Many Feature Productions

By H. H. DUNN

AS SHE walked across the huge sound stage, rapidly emptying of its actors, actresses, chorus girls and "mobs," she was one of the most beautiful, and one of the best-dressed, women on it. The man who followed her might have been up for the part of the grand duke in Graustark. They stepped into their limousine, spoke to the chauffeur and rolled out through the iron gates.

"Foreign big shots?" I asked.

"No," replied the director; "she's the designer and he's the 'ager'."

"What's that?"

"She knows all about everything women have worn since Eve and down to last night's newest revue. He takes men's costumes, made yesterday, and makes 'em five years old in twenty-four hours. We couldn't make a picture without that pair."

As we walked toward the studio offices, another car tooled through the crowd of departing players, picked up a man of professional appearance, who never has faced a motion-picture camera nor spoken a word into the microphone, yet draws a salary that would make many a bank president envious. He is the one who knows more about arms, from stone-headed war clubs to airplane machine guns, than any other man, outside military service.

Neither of these three would exchange place with any actor or actress on the screen. Yet they are only examples of hundreds of men and women who hold unusual positions—entirely unconnected with the actual filming of a motion picture—within the movie industry. From the man who makes the smoke go puff-puff from toy engines to the expert who directs the growing of whiskers of all shapes, colors and designs on the faces of the male stars, there are more than one hundred such "queer jobs" in each studio in Hollywood, with equal or even greater numbers on the New York movie "lots."

Possibly the most peculiar of all these unusual positions is that of the ager of costumes and equipment. It has been found that the cleverest designers cannot give to the costumes of mobs, vagabonds,

Jobs

serfs and savages such an appearance of age that the camera's searching eye will not reveal their newness. This is particularly true under the new method of color photography, where the color of such costumes requires an old appearance, just as did the material itself for the black-and-white picture.

These costumes, once made to historical correctness, are turned over to the ager, who has before him charts showing

Wrought-Iron Work Done by Skilled Craftsman for Movie Scene, and Elaborate Hair Dressing, the Creation of a Specialist; as Many as 200 Hair Dressings Are Sometimes Needed in One Day

design and color, as well as condition of each piece. He puts his staff of half a score of assistants to work with earth, sand, water and hot-air driers. Often he has only twenty-four hours to prepare clothes for a rabble of several hundred men and women. First of all, the clothing is beaten with earth, torn as if by accident, stained in careless spots, then tossed about in sand and water until no two pieces are exactly the same in color or condition.

In each studio there is the designer, usually a woman for women's costumes, with 2,000 to 5,000 pieces of this equipment, ranging from the skin of a saber-tooth tiger for some modernized Lilith down to complete court costumes for the ladies of a royal

banquet "somewhere in Europe." Besides these, she has designs, carefully and permanently made, for as many more costumes of ancient, medieval and modern periods. Her art department consists of men and women who might have won fame as illustrators, or even as workers in oils, but who find greater financial return in the motion-picture studios. In one, there is a woman, a former dressmaker, who can outfit more than 1,000 women in costumes of virtually every period in known history, on twenty-four hours' notice.

Unique in every studio is the geographer, better known as "location director," sometimes merely as "locater." He must find, in the southwest, an exact, or nearly exact, duplication of the scenery of any spot in the world in which a motion-picture plot is laid. The script writers must not be handicapped by time or distance. For polar scenes, the geographer sends the company to half a dozen places in the high Sierras, above the timber line, where snow and ice keep company with the barren granite backbone of the world. For the Sahara or the Gobi, he picks places in southeastern California, Arizona and Nevada; for the South Sea islands, a chain of semitropical islets along the California coast awaits his pleasure; for the coasts of the Mediterranean, the Adriatic, the Aegean, he has three or four hundred miles of sun-drenched Pacific coast, from Santa Barbara to San Diego, or even farther south.

In the files of one of the geographers, formerly a member of the faculty of one of the largest western universities, are photographs and descriptions of twenty-seven widely different "foreign locations" in southern California alone, while his south-

Zulu Spear, the Work of Arms Specialist; a Ship-Model Maker's Creation, and Exercising a Dog Motion-Picture Performer in Special Treadmill That Saves Owner Walking

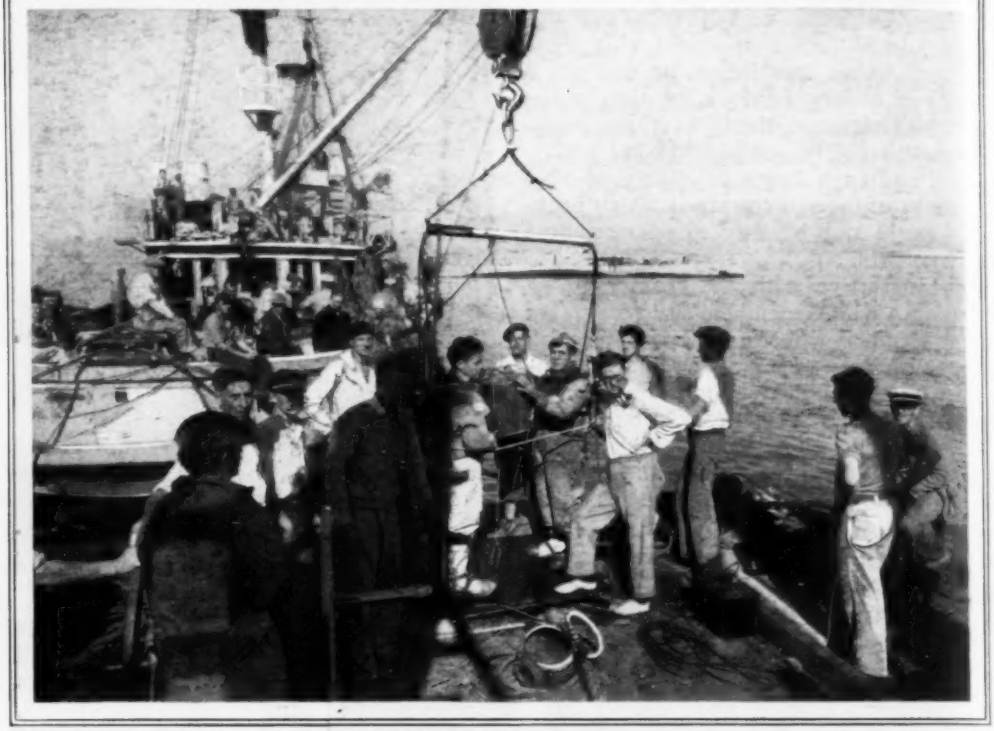
western file, covering Arizona, New Mexico, California and Nevada, contains eighty-six different spots of this kind. Within twenty-four hours, he can put a company on any outdoor location in the world. There are thirty of these geographers steadily employed in Hollywood, and each has a collection of photographs of foreign countries which probably could not be duplicated elsewhere in the world.

The detective with the "camera eye," the sleuth who remembers and recognizes every criminal whose face or photograph he has seen, is an amateur alongside another odd-job holder in motion pictures. This man—there is at least one in every studio—must know and remember a minimum of 5,000 types, men and women. Out of an estimated 100,000 persons offering their services constantly as players in motion pictures, this man must know, or have in his vast files, the descriptions, physical, mental and histrionic, of at least half that number.

Designing Costumes for Colored Motion Picture, and a Fashionable Vehicle of Other Days, Kept in Repair by a Wagon Builder

If a script calls for 100 cavemen, he must know just which 100 of all the possible cavemen are the best. If 1,000 American Indians, Zulus, Kaffirs, Bushmen, Tagalogs, Moros, or what you will, are needed, he must know just where to reach those who will make up to the greatest advantage and act best before the camera. A call for a score of courtiers and as many court ladies, a stage full of southern gentlemen and belles of civil war days, or a night club filled with apparently "happy" men and women of today, must be met within an hour, appointments arranged, costumes ordered, and presence on the lot assured.

High up in one of the lofty studio buildings is the largest collection of firearms, and, in fact, of weapons of all kinds, in the world. From it could be outfitted completely 10,000 men in the full equipment of the armies of seven different modern nations. There are stone-headed clubs, stone knives, stone hatchets, knob-kerries, assegais, bows and arrows, all the equipment of the knight of the Middle Ages, boomerangs and throwing sticks, blowguns and bowguns, arquebuses and the most modern rifles, culverins and machine guns synchronized to shoot through the whirling blades of an airplane propeller,



Motion-Picture Studios Frequently Hire Deep-Sea Divers as Cameramen or as Substitutes for the Stars in Making Submarine Films; Here Two Are About to Be Lowered

and anti-aircraft rapid-firers, with hundreds of other weapons used by man almost from the beginning of his days on earth.

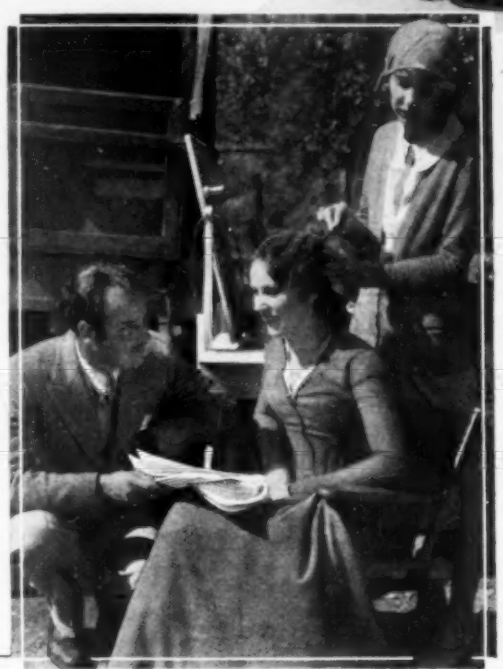
From the outside world, the motion pictures have drawn the best of the sign and house painters, who at last have become "artists." An entire set, a block of buildings, has to be painted to a given design, and all done in ten or twelve hours. With his assistants, this painter, to whom area is measured in hundreds of square feet, attacks the job with half a dozen spray pumps and tanks containing the necessary colors. He has not had a brush in his hands since he came on the lot, but with delicate sprays he and his men lay down the colors even more accurately than the cleverest sign painter of the old days. Almost as rapidly as the paint is put on, three or four tanklike vehicles, literally breathing hot air, come along and dry the job with waves of atmosphere heated to exactly the right degree.

The sculptor, whose lot in life has not always been filled with reward, has found a place in motion pictures, where he makes, in clay and "staff," reproductions of the marble masterpieces of the world or designs stage settings from the famous and enduring buildings of history. Mural painters, in larger numbers than ever could find sale for their abilities in the outside world, are busy night and day in the studios, making the walls of the sets seem what they are not. One Moor, an expert in the making and placing of oriental tiles, has built for himself a permanent position and a comfortable fortune, by the designing and making of real tile arches, floors, doorways and windows.

Every studio has its own nurseryman, its own florist, its own greenhouses, glass houses and gardens, wherein are maintained at all times collections of plants from all parts of the world. In one scene of a recent picture, 10,000 roses were required. More than half were produced from the studio nursery; the other half was purchased outside, and seven florists were needed to supply them.

On one of the lots in Hollywood stands a complete steamer of about 6,000 tons, a miniature of a large ocean liner, only about half the size of the deep-sea passenger carrier. The ship, which never has touched the sea, is so completely fitted out that she has a fully equipped engine room and a wireless cabin with all radio sending and receiving apparatus. She has been used, time and again, in marine pictures, yet she was built by a man who never had been on board a ship.

Every studio has such a man, at the head of "construction," who can build anything that is wanted and build it with the speed that is always the prime essential in preparing for the making of a picture.

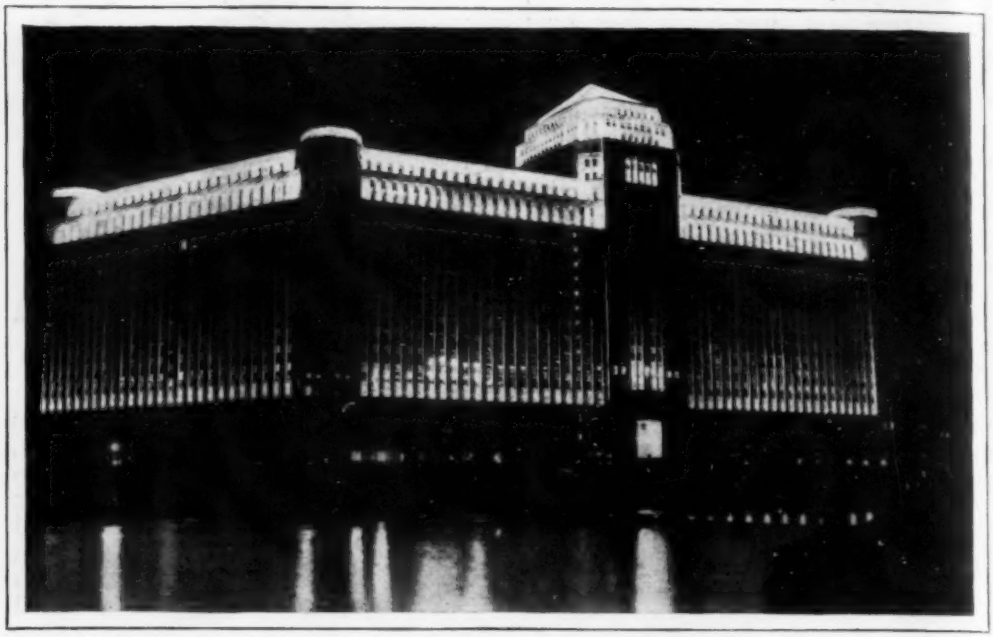


Scattered through Hollywood are more than 200 men and women who earn good salaries as technical advisers. They are persons, each of whom knows one thing superlatively well. There are aviation engineers, automobile-race drivers, retired jockeys, interior decorators, color experts, women who know music and its history, though not necessarily musicians, art experts—traveled and cultured men and women who know the world and how people live and work in countries other than the United States.

From the cold-storage warehouses, the motion pictures have taken the best refrigeration engineers and put them in charge of huge plants whose sole purpose is to provide the great sound stages with temperatures in which the players can act comfortably. For instance, during the filming of one sound picture, the actors and actresses were instructed to act as if chilled and, indeed, nearly freezing. A temperature of forty-five degrees was maintained throughout, to aid the actors in natural appearance, and on a picture from the old south, summer heat was maintained.

Mary Brian Coaxing a Racing Turtle, Fay Wray Receiving a Hair Dressing and Early Autos, Kept Repaired by an Experienced Mechanic for Use in Films Depicting Motoring of Yesterday

FLOODLIGHTS BEAUTIFY THE "BIGGEST" BUILDING



Enough Lights to Illuminate 1,000 Homes Are Used in the More Than 600 Floodlights Employed to Decorate Chicago's Merchandise Mart at Night; the River Reflects the Display

Light sufficient to illuminate nearly 1,000 homes glows from the Merchandise Mart, in Chicago, the world's largest business building, when batteries of specially placed and focused floodlights are turned on each evening. There are 607 floodlights in all, from 250 to 500 watts each, making this the second largest floodlighting installation in the world. The largest, at this date, is on the Paramount building in New York City. A special feature of the mart's illumination is that the Chicago river mirrors the display and the projectors have been so arranged, that the architectural details of the structure have been preserved. In many floodlighting displays, diffusion of the illumination leaves a flat surface, but on this building, narrow beams, properly placed, and the use of contrasting shadows, sharply reveal the structure's lines even at night. The lights start at the fourth floor. Set-back stories near the roof are brilliantly outlined, and the entire display is capped by the lighting on the massive tower at the center. Specially designed brackets, shaped to conform with the style of the building, were made to hold the projectors. Being set close to the walls, the lamps do not throw disturbing beams into the offices of the building. It contains 4,000,000 square feet of floor space and cost approximately $30,000,000.

SOUNDS HEARD THROUGH TEETH INSTEAD OF EARS

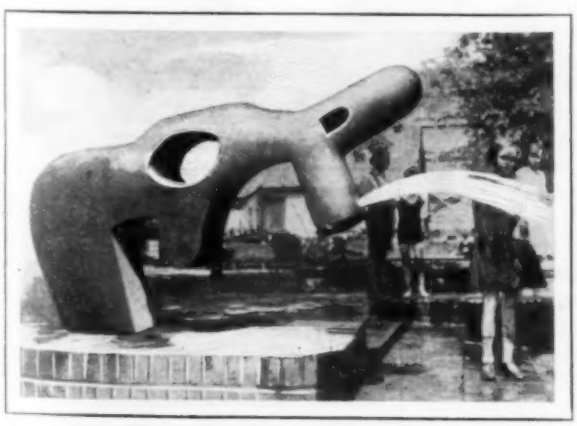
Those who cannot hear with their ears may listen through their teeth by means of an instrument invented by a professor of physics at Cornell university. Those using the device appear to sip sounds through straws, the "straws" being slender pieces of wood, sharpened at one end, which is placed in contact with a vibrating mechanism, the blunt end being held between the teeth. The vibrating element is surrounded by a sheet of rubber and attached to a wire which can be plugged into sound reproducers in a movie house or connected with a radio. The mechanism is only a trifle larger than a baseball and may be carried about by the user. Tests showed that music almost inaudible to normal ears can be plainly heard through the teeth.

ISLANDS RISE FROM THE SEA AND DISAPPEAR OVERNIGHT

Last November an ocean liner crossing the Atlantic severed several ocean cables which supposedly were resting on the sea bottom far below it, but apparently had been thrown up by a change in the ocean bed. That such changes are by no means uncommon is shown by a recent report that a vast chasm has been newly formed in the ocean bottom 150 miles east of Nantucket. Here, for a distance of 150 miles, no soundings can be taken in a section which previously gave a uniform depth of 100 fathoms. In 1927, an island between Hongkong and Manila, originally thrown up by a volcanic disturbance, suddenly disappeared and soundings taken on the spot gave a depth of twenty-five fathoms. A notorious pirate, who lived there, perished when his domain dropped from under him.

FOUNTAIN OF MODERN DESIGN FEATURES PLAYGROUND

Somewhat resembling a rhinoceros, a grotesque fountain of ultra-modern design has been erected in a children's playground in Hamburg, Germany. It is so shaped that the jet of water is thrown well to one side, where the children may stand under it in hot weather.



This Is Not a Monkey Wrench, but a Modernistic Fountain Adorning a Children's Playground in Hamburg, Germany

This Mink Took Its Own Picture When It Nibbled a Morsel of Food Tied to a String Attached to the Camera

SELF-PORTRAIT OF MINK SHOWS PHOTOGRAPHER'S SKILL

By means of a trip cord for the camera shutter, cleverly concealed in a morsel of food, a wild mink was made to take its own photograph at night. The trap was set by H. V. Roberts, of the New York State College of Forestry, who has specialized in the taking of wild-animal photographs in connection with his work.

ALLOY STEEL RESISTS EFFECTS OF HEAT AND CORROSION

Resisting the effects of heat and corrosion in a remarkable degree, an alloy steel called "Maxhete" has been made in England. It contains nickel, chromium, tungsten, copper and silicon and has been used successfully in glass-making plants where certain apparatus must withstand temperature of more than 2,000 degrees Fahrenheit. The steel does not crack or harden when quenched in water, and does not scale appreciably when allowed to cool in the air. It is being used for burner tubes, damper plates, furnace tubes, and in other places where great heat is applied.

The Pipe Framework Is a Golfing Robot Capable of Making a Perfect Mechanical Stroke, Thus Aiding Amateurs to Perfect Their Swing

GOLFING ROBOT AIDS AMATEURS IN DEVELOPING SWING

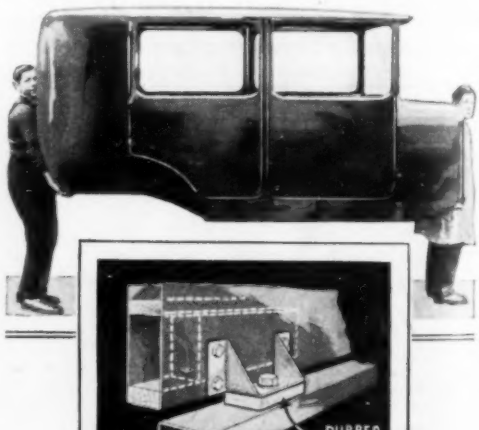
To aid amateurs in developing a mechanically perfect swing, a golfing robot has been constructed which displays the technique of the professional with the additional advantage that it does not tire or become impatient, regardless of the number of times the operation is repeated. It consists of an iron framework with metal arms which grasp the club, a lever controlling the stroke. By imitating the mechanical golfer, the student soon develops the same easy swing.

THE CHEAPEST OF METALS

Sodium now is cheaper than iron if purchased in carload lots. This metal, of extreme purity, remarkable chemical activity and low electrical resistance, costs about $11.50 per cubic foot, which is approximately the price of an equal quantity of ingot iron. Nickel is the most expensive common metal, the same volume costing $192.50. Tin, copper, aluminum, lead, antimony and zinc follow in order of cost. If more uses were found for sodium, it probably could be produced at one-third its present cost. Its occurrence, in close chemical combination with other elements, is common, but electrical decomposition is necessary to separate it, and it is so active chemically that it must be immersed in kerosene to be kept pure.

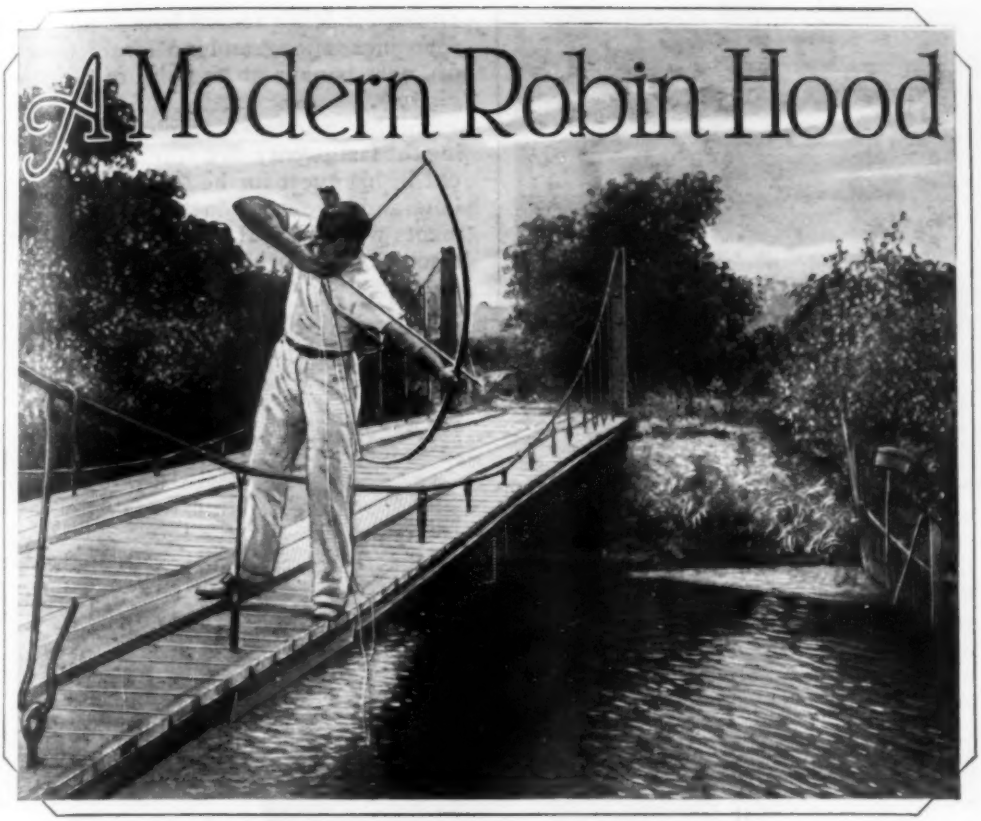
AUTO BODY IS FREE FROM RATTLES AND SQUEAKS

A radically new type of automobile body with several important advantages is being produced in England. Its two outstanding features are light weight and freedom from rattle and squeaks. The body shell is mounted at three points on rubber blocks, one block supporting each front corner and one block the rear. Floor and dash are entirely separate from the body shell, being attached to the frame. To appreciate just how greatly this construction differs from the conventional, note that it is customary to build all the body units, including floor, seats, dash, and so forth, into a single rigid structure, which is then bolted to a relatively flexible frame. When a wheel strikes a bump, the frame is bent and twisted momentarily, distorting the body, so that soon squeaks and rattles develop, whereas, with the new construction, since the body shell is mounted at only three points, distortion of the frame does not affect the body, and for this reason the body may be made lighter than usual.



Auto Body Built Independent of Rest of Car and Mounted on Rubber Blocks as Shown Below

A Modern Robin Hood



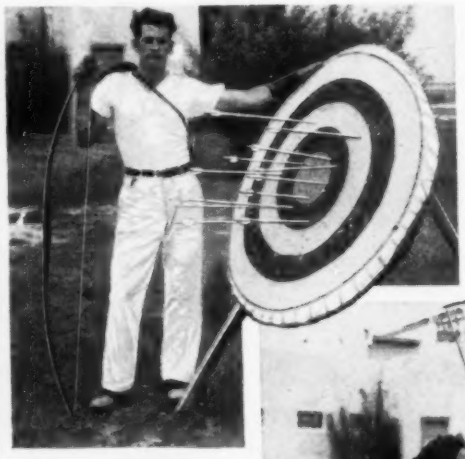
Archer Fishing from Bridge over Florida Canal; the Arrow Has a Harpoon Point, and a Seventy-Five-Foot Line Is Attached to the Feathered End of the Shaft

HOWARD HILL, champion American archer, is a more ingenious bowman than was Robin Hood and the historical English archers, for he not only hunts but he also fishes with bow and specially made arrows.

Whenever Hill goes out with his archery tackle on an angling trip, you can depend on it that he will bring home a full creel. One afternoon recently, he "caught" 196 bass, bream and alligator garfish ranging from one to ten pounds in weight with his bow and arrows. He fishes from bridges over canals and piers on the ocean front as well as from motorboats.

The arrows with which Mr. Hill fishes are made of Florida snakewood, a tough and heavy hardwood of much greater penetration power than arrows made of birch, yellow pine, cedar or similar materials. The arrows are thirty inches long, weigh 600 grains apiece and are provided with special points made of turned-down brass with a two-inch point of drill rod, one-sixteenth of an inch in diameter. Two barbs, of eight-penny finishing nails, are seated in each arrow point about three inches from the tip, being set at such an angle that they hold the hardest-fighting fish as would a harpoon. A light nine-thread linen line, such as is used commonly in fly-rod casting, is attached near the feathered end of each arrow. This line is from thirty to seventy-five feet long, its other end being fastened to the belt of the archer. The art in archery fishing is to keep the fishline attached to the arrow clear and free of all obstructions. The archer-angler frequently has to "stalk" his fish in order to gain a point of favorable shooting stance.

Hill has an unofficial record of 409 yards for long-flight shooting, which is much farther than the best of the ancient archers ever shot. His official record, made in a meet sanctioned by the National Archery

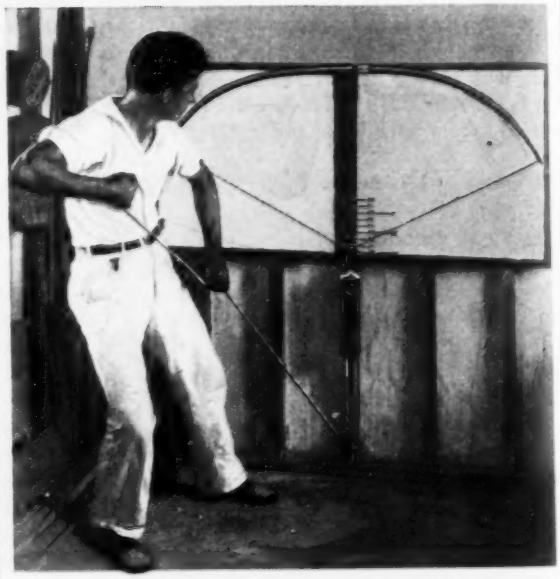


association, is 391⅔ yards. In setting these records, Mr. Hill used a Florida snakewood bow with a pull of 175 pounds, the mightiest bow ever used by either white man or savage. Florida snakewood trees grow along the coral-rock keys bordering the Atlantic. This wood is even tougher than yew, just as fast, elastic and resilient, is not as susceptible to heat and cold and has less vibration, or harshness, on the recoil.

The average archer uses a lemonwood or yew bow with a pull of from forty to sixty-five pounds. Howard Hill, by systematic training and progressive methods, built up his strength until he could shoot a 120-pound bow sixty times in quick succession without fatigue. Then he was ready for a try at the world's long-distance shooting record. You may wonder why he did not use his 175-pound bow in practice. Because that mighty bow had a service life of only about fifty shots. No other wood known and adapted to the making of archery tackle can withstand such a tremendous strain, for Hill's record bow is only fifty-four inches long and no larger than an ordinary banana at its point of maximum girth.

Hill has made all his archery tackle during the last twenty-five years. He is persistent in his quest for better hardwoods for bow and arrow production. His experiments with tropical woods led him to the discovery of Florida snakewood, which, he reports, is the best material for bow-making that he has ever worked. Unlike the majority of modern devotees of the ancient art of target shooting, Mr. Hill employs a direct point of aim instead of an artificial one—a small stake set in the ground at a given distance in front of the straw target.

The records of ancient archery, from the time of the Egyptian bowmen to the historical



Twelve Arrows in Target from Distance of Eighty Yards; Shooting with Powerful Snakewood Bow, and Testing Its Pull

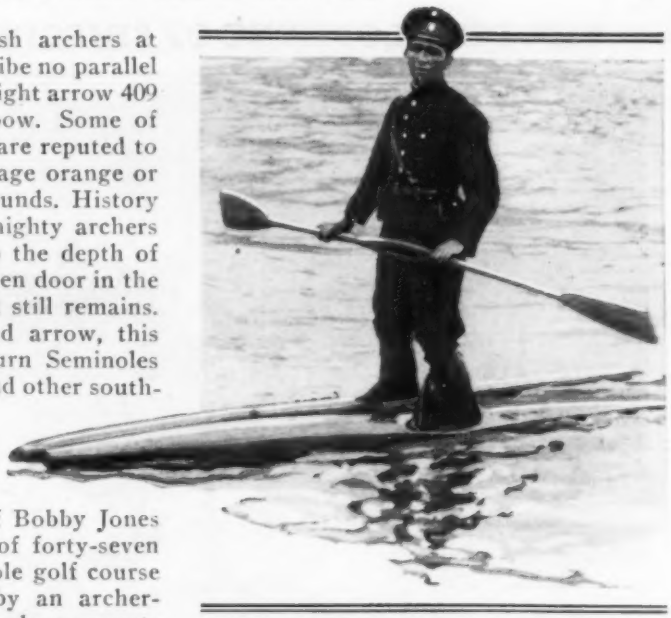
achievements of the English archers at the battle of Hastings, describe no parallel to Hill's feat in shooting a flight arrow 409 yards with his 175-pound bow. Some of the record English archers are reputed to have used bows made of osage orange or yew that pulled about 150 pounds. History relates that one of these mighty archers imbedded a battle arrow to the depth of four inches in a massive oaken door in the Tower of London, where it still remains.

In hunting with bow and arrow, this white man excels the taciturn Seminoles of the Everglades country and other southern tribesmen at their favorite sport. And in archery-golf, he occupies a position as outstanding champion similar to that of Bobby Jones in golf. Hill's best score of forty-seven for a regulation eighteen-hole golf course is the lowest ever made by an archer-golfer. In archery-golf the player counts his shots as strokes and shoots through a paper-faced metal disk on the green about the size of a golf cup.

Once while hunting wild turkeys in the headlands of the Everglades with Glenn H. Curtiss, one of the pioneers of American aviation, Howard Hill demonstrated the superiority of archery equipment over the shotgun for distance shooting. The nimrods saw a large horned owl on the limb of a tree over eighty yards away.

"I can't shoot that far with this shotgun," said Mr. Curtiss. "You'd better try your hunting bow, Hill."

The archer shot three hunting arrows at the distant owl before the bird dropped from its perch. Which goes to show that a powerful bow will outrange a shotgun, while the archer, by reason of his weapon's noiselessness, gets three to four shots at game where the average hunter as a rule seldom gets more than one.



Patrolling His Beat on Water Skis; Vienna Policeman with Oar Used for Balancing and Propulsion

WATER SKIS FOR POLICEMEN AID IN SAVING LIVES

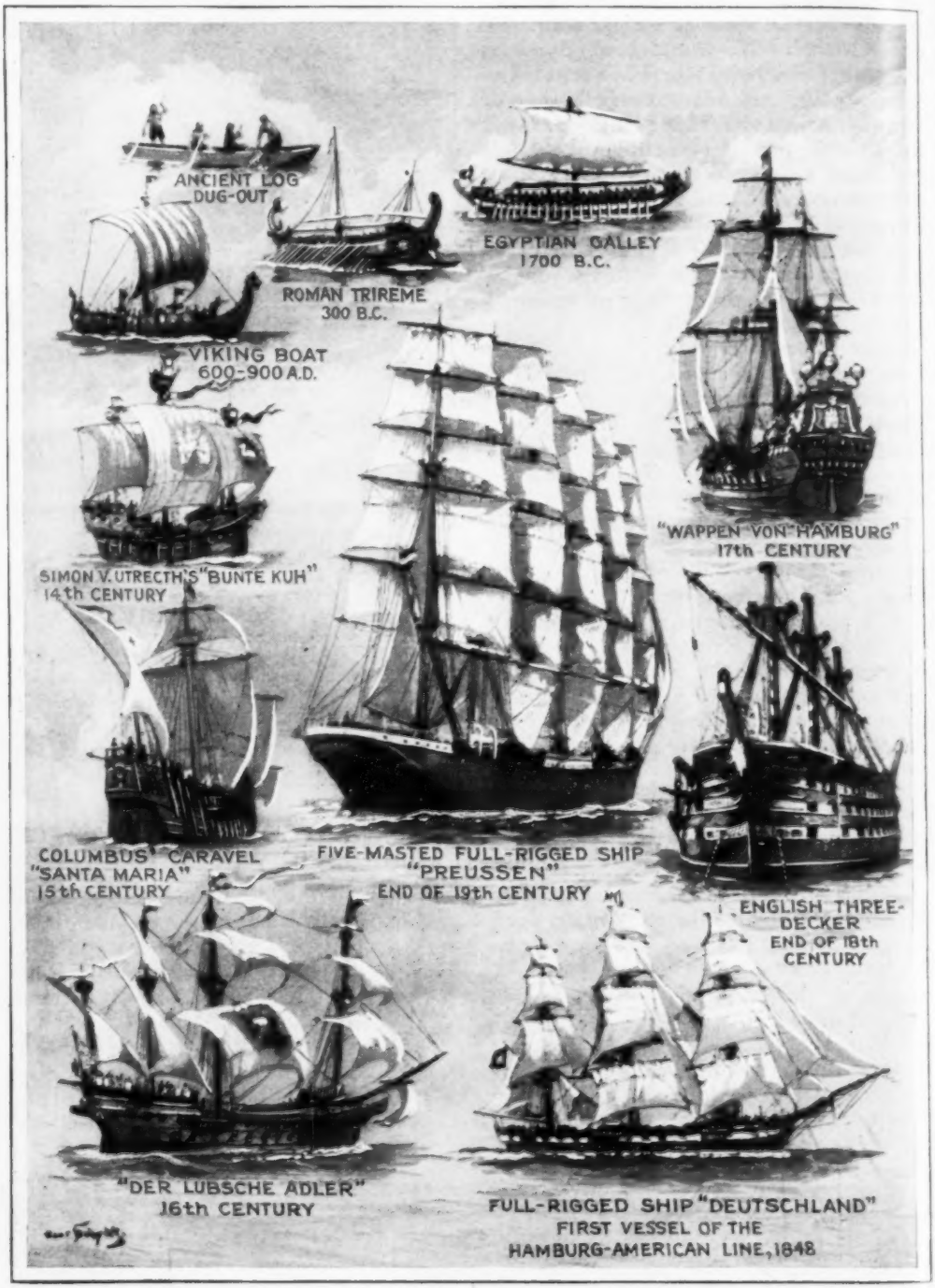
Policemen in Vienna, patrolling the water front, wear special skis with which they can walk on water, and so quickly reach persons in danger of drowning. A double-bladed oar is used to propel the wearer and help him keep his balance.

SCREEN ON GOLF-COURSE TRUCK GUARDS DRIVER FROM BALLS

To shield the driver and helper from golf balls, a service tractor on one of the courses in Lincoln Park, Chicago, has been fitted with a strong screen. It offers constant protection on the side from which the balls are being driven, and does not interfere with the vision. When not needed, it can be taken off and stowed away.

Safe from Flying Golf Balls; Course-Service Truck with Its Screen That Protects Occupants

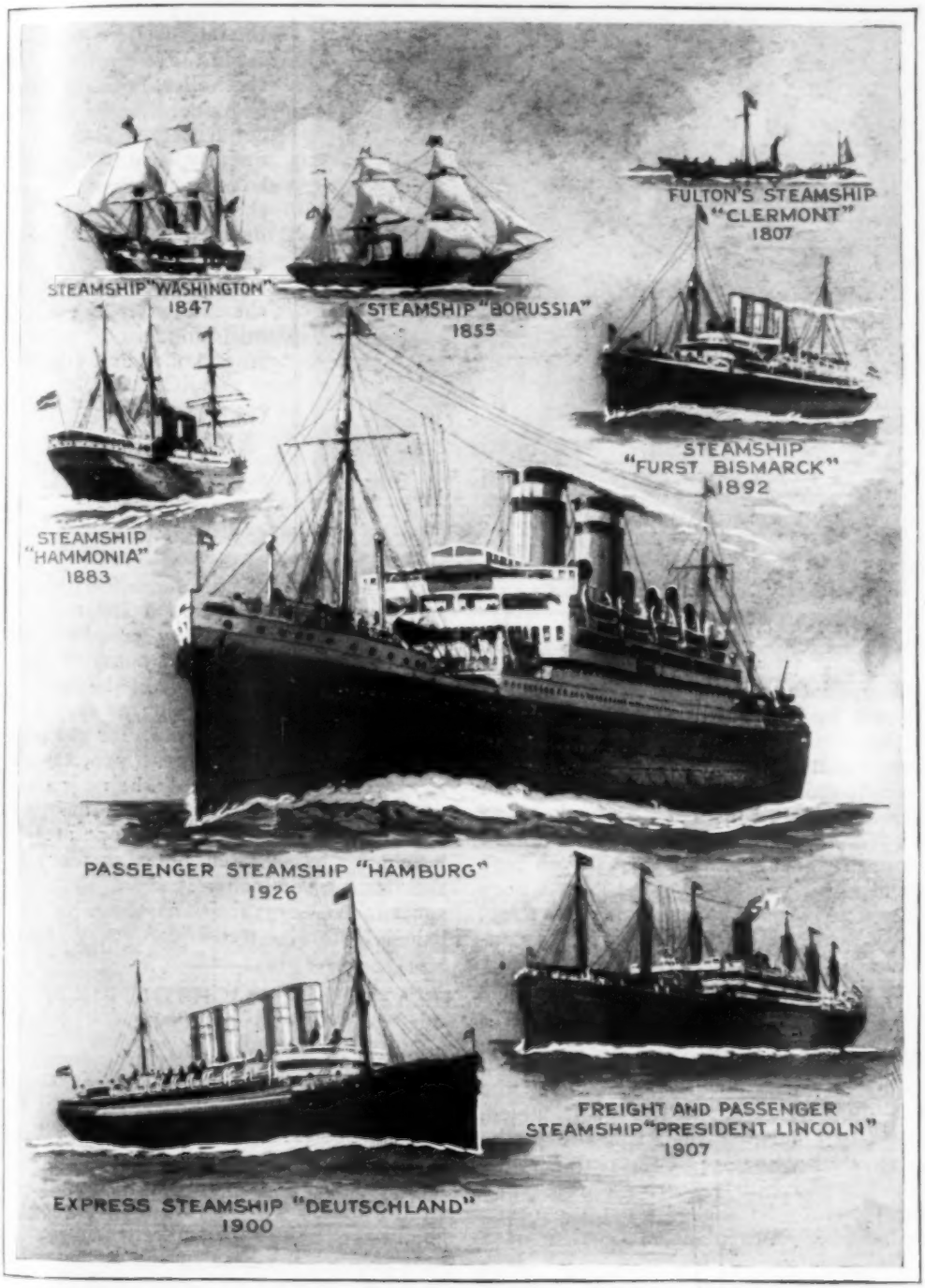
THE DEVELOPMENT OF SHIPPING FROM ANCIENT


ANCIENT LOG DUG-OUT
EGYPTIAN GALLEY 1700 B.C.
ROMAN TRIREME 300 B.C.
VIKING BOAT 600-900 A.D.
"WAPPEN VON HAMBURG" 17th CENTURY
SIMON V. UTRECTH'S "BUNTE KUH" 14th CENTURY
COLUMBUS' CARAVEL "SANTA MARIA" 15th CENTURY
FIVE-MASTED FULL-RIGGED SHIP "PREUSSEN" END OF 19th CENTURY
ENGLISH THREE-DECKER END OF 18th CENTURY
"DER LUBSCHE ADLER" 16th CENTURY
FULL-RIGGED SHIP "DEUTSCHLAND" FIRST VESSEL OF THE HAMBURG-AMERICAN LINE, 1848

Courtesy Hamburg-

From Log Dug-Outs to Full-Rigged Sailing Vessels; Centuries of Shipping Progress at a Glance; the Greatest Advance Was Marked by the Harnessing of the Winds

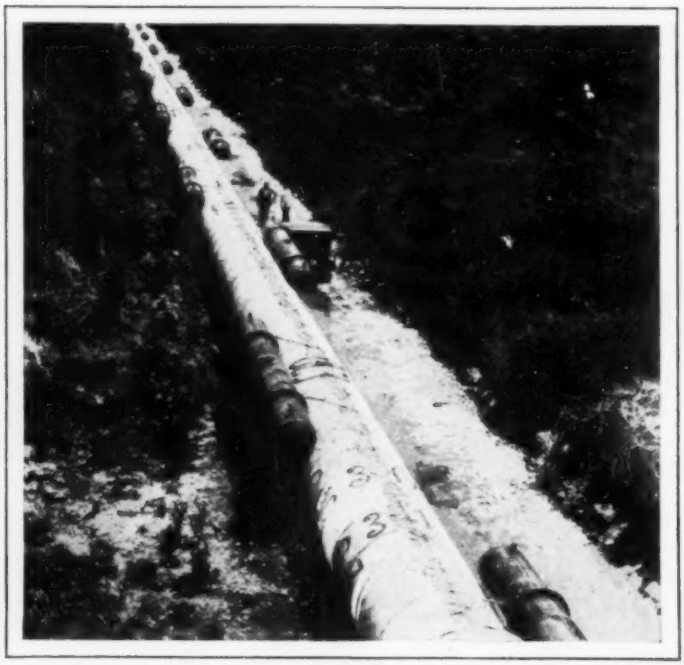
LOG DUG-OUT TO THE PALATIAL LINER OF TODAY



American Line

From Wind-Blown Ships to the Era of Engine-Propelled Giants, Luxuriously Equipped and Capable of Speeds Far Beyond the Dreams of the Early Mariners

NEW EFFORT PLANNED TO HARNESS OCEAN POWER



Section of Mile-Long Pipe as It Was Being Towed on Pontoons to a Position in the Gulf Stream; It Sank Before It Was in Place

Despite two failures, Georges Claude, French inventor, is making a third effort to harness the Gulf Stream for an ocean power plant. Each previous failure has been due to inability to place in position in the sea a length of insulated steel tubing six feet in diameter, and more than a mile long. In each instance the 300-ton pipe went to the bottom before it had been drawn to proper position for lowering, but a third section is being made to continue the experiment. When successfully placed the pipe will extend from the Cuban coast at Matanzas and suck up water from a depth of more than one-third of a mile. This water will have a temperature of about fifty degrees and will provide the cooling necessary for the plant which, instead of burning fuel, will utilize the relatively hot surface of the Gulf Stream, which is about forty degrees warmer than the water to be sucked from the ocean bed. The ocean plant makes use of a boiler, turbine and condenser which serve in the ordinary manner except that the boiler is at the temperature of the surface water, and instead of being subjected to hundreds of pounds of pressure, the boiler will have much less than the atmosphere outside. Even the low pressure of the boiler, however, is to be higher than that of the condenser, and consequently, steam from the boiler would flow through the turbine to the condenser, while cold water from the depths maintains the low pressure of the condenser by cooling and condensing steam from boiler and turbine.

GAME FISH GROWN BY GOVERNMENT HELP ANGLERS

Provision for spending $5,000,000 over a period of five years for propagating game fish is contained in a bill recently passed by congress, the bureau of fisheries planning to utilize waste lands in the interior for growing the fish, which at the same time will serve as a food crop for the agriculturist. The government project will support the work already being carried on by the many states which maintain hatcheries. Individual states operate 359 hatcheries, almost ten times as many as the bureau of fisheries now has, and sportsmen's organizations have established 150 active nurseries.

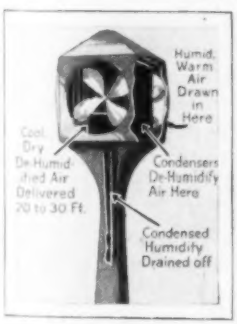
HEATING AND LIGHTING FIXTURE COMBINED IN ONE UNIT

Electric heating and lighting facilities are combined in a single ceiling fixture unit by one British manufacturer specializing in electric heating by radiation. The combination is particularly suitable for large rooms, such as hotel lobbies and auditoriums. The fixture is hung at a height above the floor so that the radiated heat reaches the base of the walls. The heating elements are contained in the outer part of the fixture, and the illuminating elements within the fixture, thus combining beauty and utility.

MYSTERY OF RADIO ECHOES PERPLEXES SCIENTISTS

"Long time" radio echoes, heard at an interval of a second or more after the original signal was sent, have inspired fresh interest in these phenomena and given rise to at least two theories of explanation. Had they been echoes of signals that merely went once around the world, they would have returned in one-seventh of a second or if twice, in two-sevenths of a second, according to O. H. Caldwell, former member of the Federal Radio commission and well-known radio expert. There are now two theories to explain these delayed echoes, Mr. Caldwell declares. One is that they are reflections from a collection of particles far out in space, a region visible as the zodiacal light which can be seen after sunset and before sunrise as a band of twilight in the sky. It is a sort of Saturn's ring around the earth and some radio men have felt that reflection from it causes the radio echoes. Another theory is that the echoes are merely retarded transmissions from the earth's own vicinity beneath the Kennelly-Heaviside layer. Attempts have been made to detect radio echoes from the moon, but no authentic case of "moon echoes" has been recorded.

FAN TO COOL AND DRY AIR HELPS PROMOTE HEALTH


Humid. Warm Air Drawn in Here
Cool Dry De-Humidified Air Delivered 20 to 30 Ft.
Condensers De-Humidify Air Here
Condensed Humidity Drained off

Air is cooled and brought to the proper humidity by a special fan developed for store use, but also suitable for home installations. It operates in connection with a small refrigerating plant and furnishes cool air at the rate of 1,200 cubic feet a minute, blowing it a distance of twenty to thirty feet. As warm air is drawn in, it is chilled and excess moisture removed. The fan occupies but little space, is not expensive to operate and several may be run from a refrigerating plant of suitable size.

Mirrors at Intersections of Narrow Streets in Brussels Give Auto Drivers a View of Traffic

MIRRORS AT STREET CORNERS AID AUTO DRIVERS

Large mirrors have been placed at intersections of some of the main streets in Brussels so that drivers may see the traffic conditions before they reach the crossings. The mirrors afford a clear view around the corners and are high enough not to interfere with pedestrians.

VULCANIZED LIGHT EXTENSION FREE OF FIRE DANGERS

Eliminating much of the danger of shorting or of fire in using an electrical extension, a rubberized cord now is on the market. Cord, socket and attachment plug are vulcanized, thus making it one piece of rubber, while the handle contains a tap for other electrical tools.

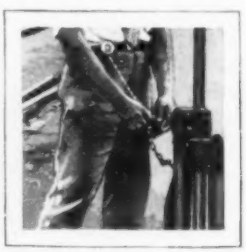
OUTBOARD MERRY-GO-ROUND LATEST WATER SPORT

Thrilling Motorboat Races Are Possible in Small Space with This "Merry-Go-Round" Arrangement; the Lines Are of Different Lengths So That Boats Can Pass Each Other

Outboard-motor boats in a thrilling "merry-go-round" race amused and interested spectators at a Florida resort recently. Jumping platforms were introduced, and a hurdle race added variety to the contest. The boats were tied through swivel connections to a twenty-two-foot telephone pole, imbedded firmly in the bottom and extending about twelve feet above the surface of the water. The length of the ropes to the boats was varied, allowing some of the craft to operate on a shorter radius and so pass the others.

AUTOMATIC KEY-CHAIN REEL PROTECTS SWITCHMAN

When a Los Angeles switchman nearly lost his life when his key chain caught an obstruction as he was jumping off a car, he decided to invent something that would prevent such accidents. He now has a chain holder, about the size of a watch, which can be attached to his belt. It is fitted with a spring arrangement, so adjusted that the twenty-four-inch chain and the bunch of keys are quickly brought back into place automatically as soon as the keys are released, doing away with a dangling length of chain.



WHY LEAVES FALL IN AUTUMN

Nature's wonderful skill in maintaining balanced conditions is the chief reason why the leaves fall in autumn, according to Martin L. Davey, well-known tree expert. There are huge numbers of leaves on every tree, he explains, and all the leaves give off moisture. In the winter, the tree roots absorb very little moisture so that, if the leaves remained on and functioned, the tree would be literally drained dry and would wither away. Before the leaves fall, the tree absorbs most of the food substances they manufacture, and a layer of thin-walled cells is formed at the base of the leaf where it is attached to the twig. This layer becomes a zone of weakness allowing the leaf to fall of its own weight or to be easily blown off. The scar that is left is protected by a substance which is practically waterproof. Since the tree bark is almost impervious to moisture, the tree is literally "bottled up" for the winter. During or after a long drouth in summer, the leaves fall early, as the tree naturally hastens the process in order to prevent too much evaporation of its moisture.

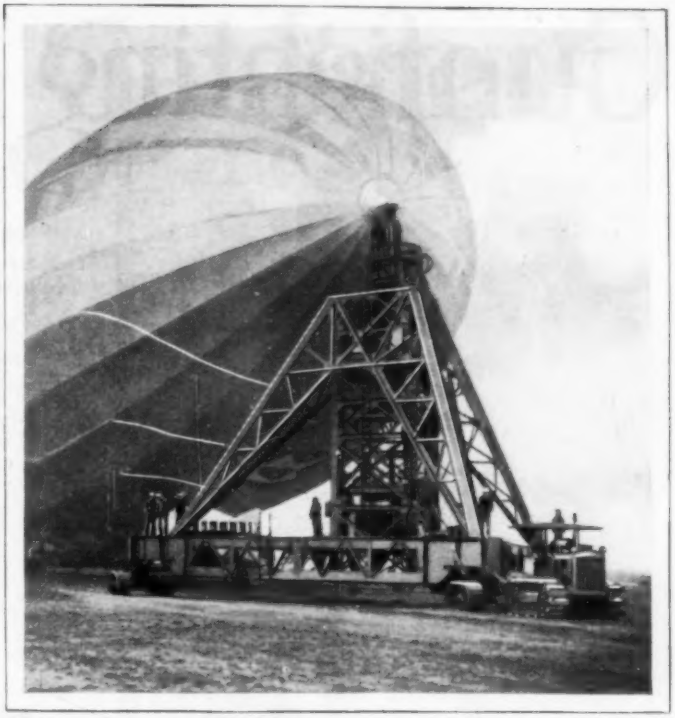
WINDOWS CLOSED BY FALLING RAIN

When rain falls on the sill of an electric window recently invented, a circuit is closed and the window is automatically lowered, slowly and noiselessly, sparing the housewife the task of running from room to room to prevent damage from a storm. The apparatus may also be set by a clock to shut the window at any desired time whether rain is falling or not.

PICTURE CARD HAS PHONOGRAPH RECORD

Talking picture postcards that carry a verbal message from the sender are being produced in Germany. These cards bear a photograph of the sender, and the voice is recorded on a small phonograph disk attached to the back of the card. The recipient places the postcard on the phonograph and listens to the reproduction of the sender's voice.

Miniature Phonograph Record Which Bears Photograph as Well as Voice Record of the Sender



Portable Mast for Dirigible in Use; It Can Be Hauled About by a Tractor and Requires a Smaller Ground Crew

PORTABLE MAST FOR DIRIGIBLE DECREASES GROUND CREW

Successful tests recently were conducted with a portable mooring mast for the navy's dirigible, the "Los Angeles." The mast, consisting of an iron framework on rollers, can be drawn about by a tractor and offers added facilities for landing as well as launching. It greatly decreases the number of men composing the ground crews for either take-offs or landings.

PILE DRIVER WORKS AS PISTON OF GASOLINE ENGINE

A pile-driver hammer, operated by an internal-combustion engine, has been developed by a German manufacturer. The hammer head forms the outer end of the piston rod. The whole outfit weighs about 450 pounds. It requires only about two quarts of fuel and a little lubricating oil per day. Ignition is provided by a storage battery, and the hammer delivers its blows continuously until the current is shut off.

Gunfighting Police

By COL. ROY D. JONES
Secretary United States Revolver Association
(as told to John F. Coggswell)

DAY was breaking. Around the base of a small brush-covered hill, near a large eastern city, were strung more than a hundred police officers. Guns in hand, they strained their eyes through the dim light toward the top of the rise.

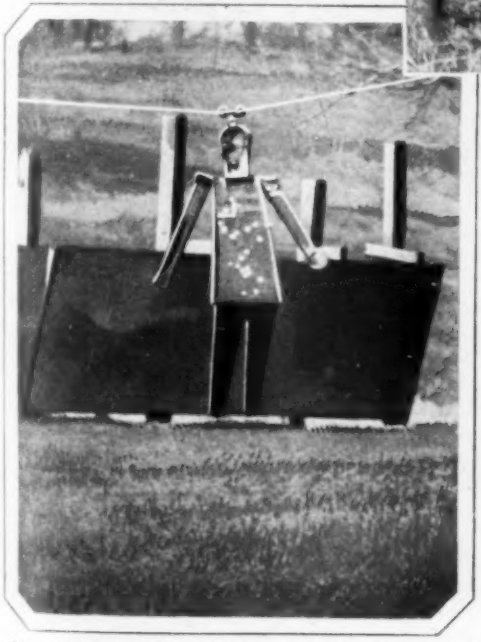
On the hilltop, two desperate gunmen were at bay. Every few minutes they sent a fusillade of revolver bullets down the slope toward the officers. Both had done murder many times over and were

Various Revolver Holds and Firing Positions; at Top, Two-Handed While Lying Flat; in Circle, from Cover; Above, the Crouch, and, at Right, Two-Handed Hold

Doom Gangsters

prepared to exact a high price for their lives.

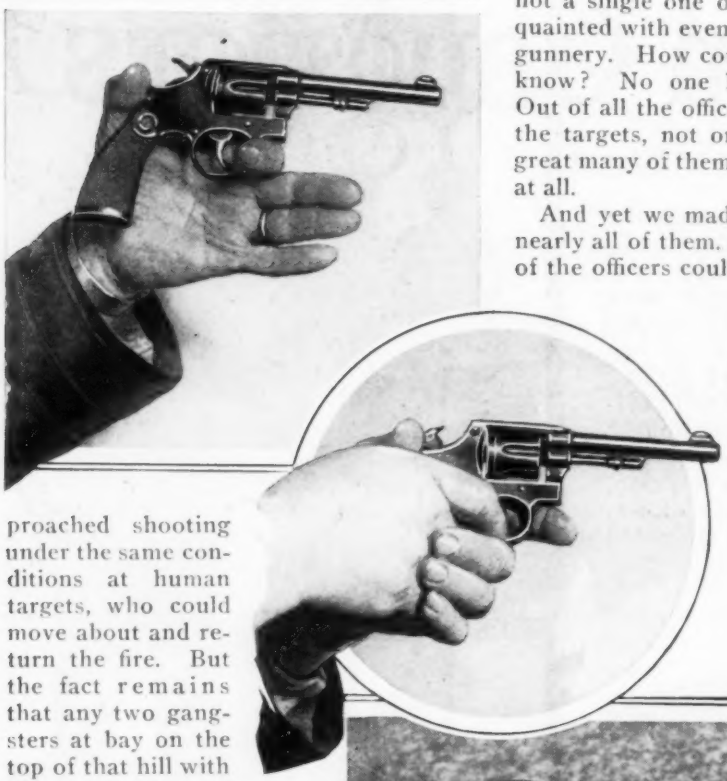
As the sun broke through the morning mists, the cordon of officers began closing in on the criminals. They accompanied their advance with a constant bombardment of the thicket. The air was full of lead. It seemed nothing could live through the hail of bullets, but still the bandits fought on. Finally the shooting from the top of the hill came to a stop. For a few minutes the officers waited, then they surged forward up the slope. Just before they reached the crest, one of the outlaws stepped out of the thicket, his hands in the air. The other gunman lay on his face, a bullet hole in his head. Investigation showed that he had used the last bullet in his gun on himself, rather than surrender. Not a single bullet had touched either bandit, in spite of the fact that the police had fired more than 2,000 shots.



Above, **Results of Good Aim at Swinging Target, and, Below, Moving Target on Cable**

That incident is indicative of the conditions that prevailed generally in police departments a few years ago. A few months past, at the graduating exercises of a police school, such as many large cities now maintain to make their policemen a gunfighting first line of defense between the citizen and the criminal, twenty-five officers reenacted this "Battle of 2,000 Misses" with far different results.

In the brush, silhouette targets had been set up in no better sight than the bandits had been—just dimly outlined in the bushes. Two hundred and fifty shot were fired. The targets were hit 249 times. When one of the policemen opened his gun to empty it of the discharged shells, he found that one had missed fire. Of course, that record could hardly be ap-



proached shooting under the same conditions at human targets, who could move about and return the fire. But the fact remains that any two gangsters at bay on the top of that hill with those twenty-five policemen advancing upon them would have been quickly wounded or killed.

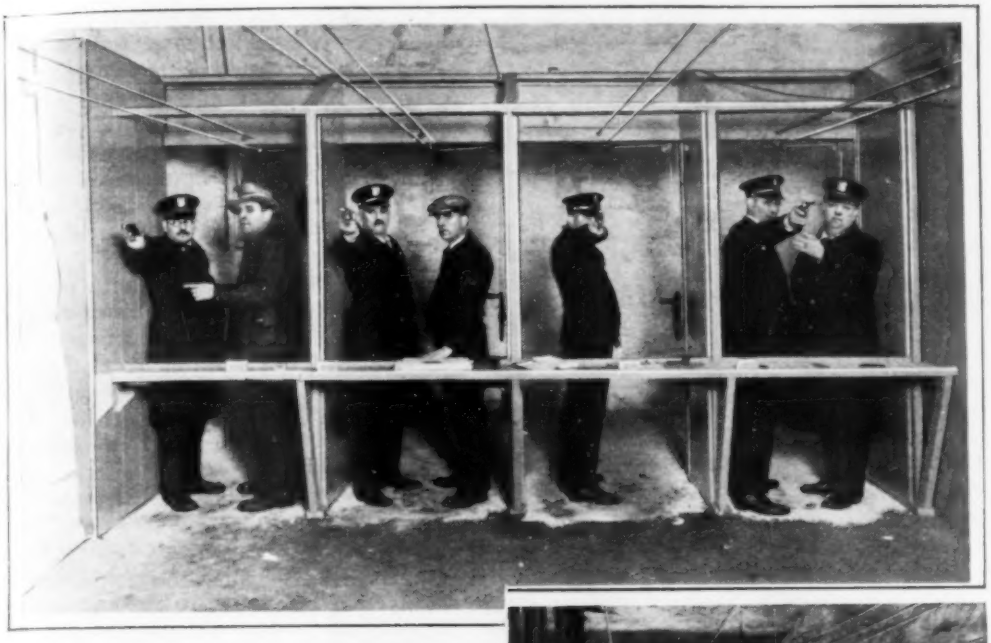
The only gunman who can cope with the bad gunman is the good gunman. And most of the police officers walking beats in American cities today are not gunmen—good or bad. In confirmation of that statement, let us consider the state of affairs in one city to which I was called to assist in establishing a gunnery school for police officers. The first class consisted of 100 men. To get a line on what they knew about their weapons, I took them down to the revolver range, divided them into squads and told them to go ahead and show me some shooting.

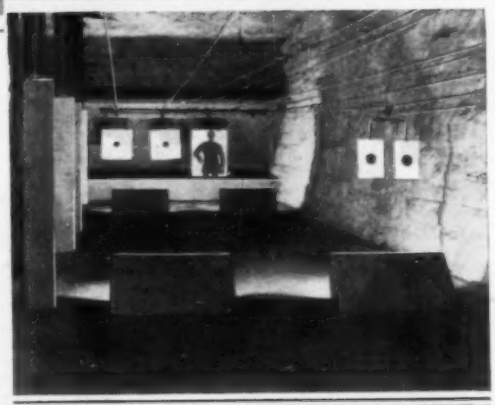
As soon as I saw them aim at the targets, I knew that not a single one of the hundred was acquainted with even the rudiments of hand gunnery. How could they be expected to know? No one had ever taught them. Out of all the officers who blazed away at the targets, not one got a bull's-eye. A great many of them couldn't fire their guns at all.

And yet we made good gunmen out of nearly all of them. Within a month, most of the officers could bang out pretty good scores on the indoor range. That was the first step in their gun-fighting education—to teach them how to hold their sights on the target, squeeze the trigger and how to care for their guns.

The class gained some knowledge of slow and rapid fire at targets and then were ready for

Above, Correct Two-Handed Revolver Hold, and, Below, Tetrault and Gallagher, Crack Shots of the Springfield, Mass., Department



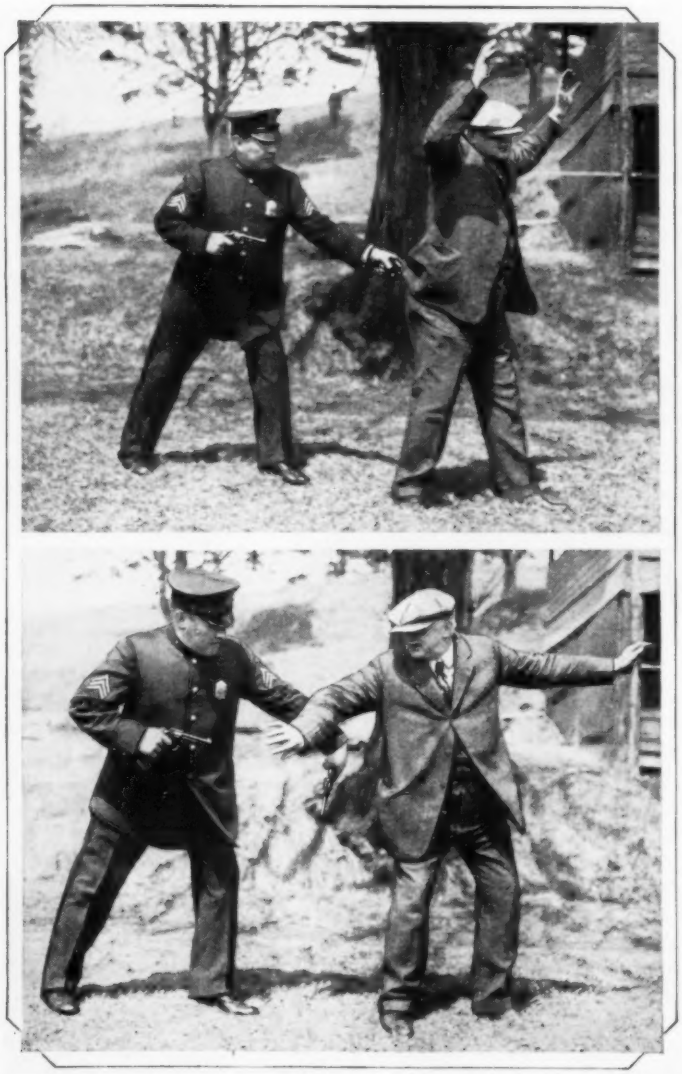


Policemen at Revolver Practice in Gallery with Targets That Run on Carriers

schooling in gunfighting. The first step was to get them to carry their guns in position, readily accessible in case of trouble, as the primary essential of good gunfighting is to get the gun out and into action in the shortest possible space of time—a quick draw, if you please. Years of experience have taught the best gunfighters of the nation that the ideal place for a holster is in front of the right hip, with the loop on the holster so fastened that the gun will hang diagonally with the butt straight back toward the hip and the muzzle squarely between the legs.

A draw from this position consists of one movement only. If the gun hangs properly, the right hand comes up from its position as it hangs at the side, three fingers hook under the butt, start the gun out and, as it begins to leave the holster, the forefinger finds the inside of the trigger guard and the thumb the top of the hammer, ready to cock the weapon the instant the muzzle swings toward the target. A quick draw can only be acquired by much practice. The police classes put in many a weary hour learning to draw and also to "aim with the thumb." During this instruction, all guns are empty.

Aiming with the thumb is simply a matter of holding the revolver in such a manner that, when the sights are lined up on



Sergeant Tetrault Shows Proper Way to Disarm Bandit; Stand as Far Back as Possible with Gun Back; if Bandit Whirls, Counter with Left Arm

the mark, the thumb is also pointing at it. A police officer rarely does his shooting under conditions that prevail on the target range. More likely, the time he must shoot straight or die is in the middle of the night, in the pitch-black interior of a looted store, or down an alleyway where the beams from the street lights send not a single ray. Under such conditions, he cannot see his sights. But he can point his thumb at even the dimmest target—try it yourself and see how easy it is to do—and if his gun barrel is held parallel to his thumb, a thumb aim is just about as good as a sight aim, when the target is as big as a man.

Shooting from the hip and other trick firing have no more place in gunfighting than they have in target shooting. As the first step in the training for real gunfighting, the officer takes his stand, hands at side, twenty-five yards from a steel target shaped like the silhouette of a man's body. However, the silhouette is but three feet tall and half the breadth of a man. In short, conditions are the same as shooting at a man fifty yards away.

The silhouette target is mounted on a revolving rod, so that it may be turned at any angle from the shooting point. When the officer is ready for the test—gun holstered at his side—he sees only the sharp edge of his target. Without a warning word, the target suddenly swings to present its full expanse. It remains in this position for exactly three seconds, then swings away again.

In the interval, the officer must draw his gun, aim it and fire. The gunnery students are instructed to fire at the middle of the body and not to try for head shots—a bullet in the midriff will stop a bandit just as quickly as one in the head, and the body is the bigger target.

An average shot will place four bullets out of ten in vulnerable spots of the silhouette, a good shot will average five or six hits out of ten and an expert seven or better. Time after time, I have seen both Sgt. V. M. Tetrault and Patrolman Ray Gallagher, of the Springfield, Mass., department, register all ten shots at twenty-five yards and frequently repeat the performance at thirty-seven and a half yards

—equivalent to a man at a distance of seventy-five yards—to which range the students graduate after becoming proficient at the shorter distance. However, these two are among the best shots in the country at such targets, and police officers need not develop such uncanny accuracy to be far ahead of the usual gangster.

Proficient at the silhouettes, the student advances to still more difficult shooting. Out on the range, there are three steel plates, each a foot long and three inches wide. These are hinged to wooden posts at the center so that they can stand upright or lie flat. One plate is twenty yards from the shooting point, another thirty yards and the furthest, thirty-seven and a half yards. They are placed at widely separated angles of fire.

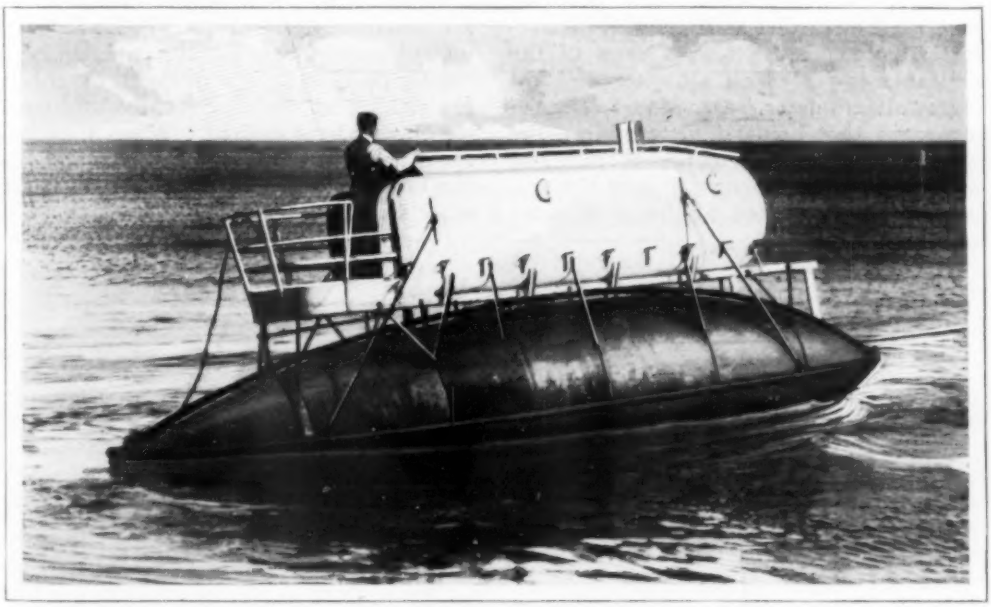
When the marksman takes his stand at the mark, all three plates are lying flat. Suddenly, one of them—he doesn't know which it is to be—pops upright. His problem is to knock the plate flat again with one shot, and that shot must be fired within two seconds of the time the plate flashes into view. Understand that, to flatten the target, he must hit it somewhere on the top half—thus his mark is but three by six inches.

By the time he has graduated from these targets, the officer is a marksman or he never will be. Then we put him at what, to all intents and purposes, except that no return shots are fired, is real man shooting. A hundred yards down the range there hangs from a cable a wild-looking effigy. It has the outline of a human being, six feet high, and is hinged at the neck, shoulders and hips.

The contraption runs on a wire stretched from the distant point to a position just above the shooter's head. At a signal, the effigy starts along the wire toward the officer. It swings from side to side, the arms flail about, the body jumps back and forth, and the legs kick. And yet we expect the student to get at least three out of five bullets into a vulnerable part, before the target reaches the fifty-yard mark. When he can do that or better, he's a real shooting man.

MOTORBOAT LIKE TORPEDO WILL NOT SINK

With a torpedo-shaped hull and a water-tight cabin compartment on top, a novel motorboat, designed by a German engineer, has been tested with the idea of using it for a journey across the Atlantic. The hull, or body, is of steel.



Queer Motorboat German Engineer Has Built for a Possible Trip across the Atlantic; It Has a Water-Tight Compartment or Cabin Mounted on the Torpedo-Shaped Hull

Testing Odors in Special Apparatus That Tells Which Aromas Attract Corn Borers So That They Can Be Trapped

ODORS THAT LURE CORN BORER TO AID IN WAR ON PEST

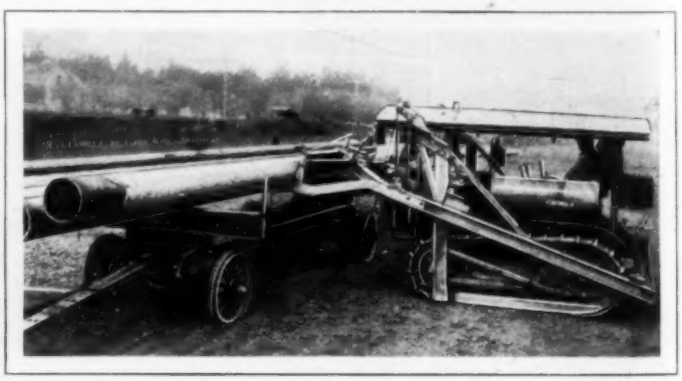
Government scientists have been experimenting with various odors that attract the corn borer in order to find a lure that can be used to entice the pests into traps and so protect the corn. So far, five odors from various parts of the corn have proved effective and more than 900 have been discarded as lacking attractiveness. To make the test, a drop of the substance is placed on a blotter and put in an "olfactometer," a specially designed apparatus that helps in determining the strength and reaction of the odors. The moth is put in another section of the machine and, if attracted by the smell, tries to reach the blotter.

WEIGHT OF LIGHT FROM SUN IS MANY TONS

Science has put both heat and light "in the scales" and weighed them with the result that an estimate can be made as to the weight of the light radiated from the sun. Accurate measurements have shown that a searchlight, requiring the equivalent of fifty horsepower to operate, would radiate one-twentieth of an ounce of light and heat if it were kept working constantly for 100 years. On this basis, scientists estimate that the sun's whole surface is emitting over 4,000,000 tons of light every second. This means that the sun is becoming some 360 billion tons lighter every twenty-four hours. But this has been going on for millions of years, and scientists are assured that the process will continue for many thousands of centuries to come, so there is no need for immediate concern that the sun will waste away. Even wireless waves weigh something. Some of the big radio stations will have transmitted fractions of an ounce apiece when they have operated a century.

TRACTOR FITTED WITH CRADLE SPEEDS HANDLING PIPE

Pipes for natural-gas lines in California are conveniently and quickly loaded and unloaded from trucks with the aid of a tractor that has an arm or cradle extension for picking up the pipe lengths and placing them where desired. When the tractor is not used for this purpose, the cradle can be converted into a scraper for filling trenches with earth.



Handling Pipe with the Special Loader-Tractor; the Grappling Arm or Cradle Can Be Lowered for Pushing Dirt

With His Parachute Beginning to Open After He Has Fallen Only Twenty Feet; Remarkable Photograph of Jump Made by Manley J. Merrell, Instructor at Parks Airport, East St. Louis, Illinois

SAFETY OF MODERN PARACHUTE PROVED IN MANY TESTS

While parachute jumps at low altitudes generally are considered more hazardous than those at several hundred feet and more, chutes of today are being developed to open quickly after the rip cord is pulled, so that some of the danger of a low jump is reduced. In the accompanying illustration, showing Manley J. Merrell in a jump at Parks airport, East St. Louis, Ill., the parachute is opening after Merrell has fallen but twenty feet. The rip cord and ring can be seen in his hand.

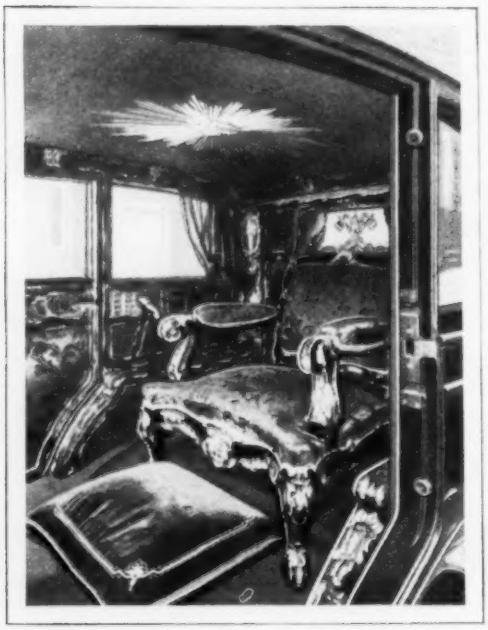
ONIONS GIVE DOGS ANEMIA

While experimenting with a diet for dogs to prevent the disease known as black tongue, a malady somewhat similar to pellagra in human beings, it was found that onions produced anemia. The onions, cooked or raw, produced severe cases of anemia when fed in quantities of more than half an ounce for each two pounds of body weight of the dog. Smaller amounts produced milder cases of the disease, which grew in severity as the onion ration was increased.

DETACHABLE SPIKED SHOE SOLE PREVENTS SLIPPING

To prevent slipping on ground or pavements, detachable steel soles equipped with calks now are available for leather or rubber boots and heavy shoes. The sole is held to the shoe by leather straps.

GILDED THRONE IN AUTOMOBILE PRESENTED TO POPE PIUS



Interior of Auto Given to Pope Pius, Showing Luxurious Fittings and Throne Chair

As a gift from the city of Milan, Pope Pius XI recently received a magnificent automobile in the tonneau of which is a massive gilded throne for a seat. The luxurious car, for the exclusive use of the pontiff, is furnished with interior fittings of gold, silver and ivory.

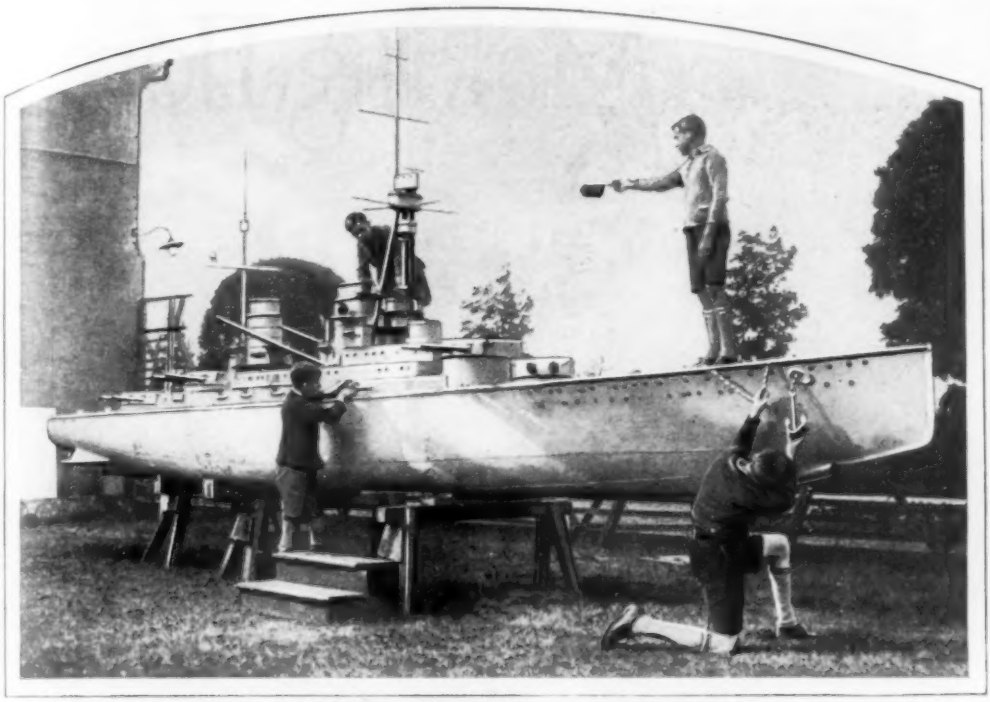
CRICKET IS MASTER MUSICIAN TALKING FILM REVEALS

Crickets are more skillful, in some respects, than master violinists, for they can play, in a fiftieth of a second, notes that a human fiddler can reach only by sliding his finger far down on the "E"-string, and the insect repeats the feat four times at every stroke of its "bow." Dr. Frank E. Lutz and W. E. Hicks, of the American Museum of Natural History, recently assisted in the production of a "talkie," or rather a "chirpie," of a performing cricket and learned many interesting things about this famous natural musician. After the film had been prepared, the scientists made microscopic measurements of the alternating shadows and clear bands on the edge of the talking film. This study revealed that the human ear is too sluggish to hear all the sounds when the cricket chirps. They found that the insect does not slide its tiny file near the edge of its wing clear across the other wing edge at one stroke to produce a chirp. The film showed that each chirp separates itself into about four subdivisions or "pulses" with imperceptible pauses between them. Each pulse lasts, on the average, about one-fiftieth of a second and each pause is somewhat less. The human ear, too slow to catch these divisions, interprets the chirp as a single sound. Further study of the music showed that a pulse starts at the high pitch of fifth "D" above middle "C" of the piano keyboard, rises momentarily a little higher, then slurs downward approximately a whole tone, all in about one-fiftieth of a second.

HAND TESTER TELLS IF MEATS ARE TOUGH OR TENDER

To tell just how tough or tender a cut of meat may be, the department of agriculture has devised a simple tester which is being used extensively in research to find out why meat from one animal is more tender or tougher than that from another. A knife blade is pulled through small round pellets of the sample by means of a crank, and a scale in the center of the apparatus records the amount of pressure required to make the cut.

Testing Steak in Puller That Registers the Force Needed to Cut It



German Lads Examining Remarkable Model of the Cruiser "Hindenburg," Which Was One of the Principal Exhibits at a Recent Show in Potsdam

MODEL OF GERMAN BATTLESHIP FEATURES BOAT SHOW

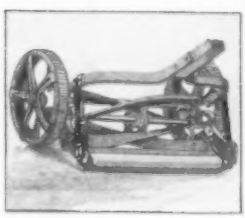
One of the most interesting objects at a boat show held recently in Potsdam, Germany, was a large model of the cruiser "Himdenburg." Details such as turrets, guns, anchor and observation towers were faithfully reproduced in accurate scale.

PLANTS SPROUT FROM PLASTER ON BUILDING WALLS

When newly plastered walls of a Philadelphia building suddenly sprouted plants, it appeared that the structure would have vertical gardens, and, along with the mystery, the contractor was threatened with a suit. Dr. Rodney H. True, of the University of Pennsylvania, was called in to solve the riddle. He first determined that the vegetation was a plant that grows in alkaline soil, principally on the edges of deserts, and frequently attains a height of two feet. The seeds are used in horse medicine and are often imported from the Sahara desert regions. It was found that a druggist had thrown a quantity of the seeds into refuse near a builder's sand pile, some of them having fallen into the sand and become mixed with the plaster. The growth was eliminated by spreading a thin coating of new and seedless plaster over the original.

LAWN-MOWER ROLLER SPRINGS GIVE SMOOTHER CUT

Better performance is assured from the lawn mower by the use of pressure springs that hold the roller on the ground, preventing the mower from bucking in tough grass and giving smoother, more even cuts. The springs fit practically all makes of mowers and can be attached without altering the machine.



¶Names and addresses of manufacturers of articles described in this magazine will be promptly furnished, free, by our Bureau of Information.

Making Home

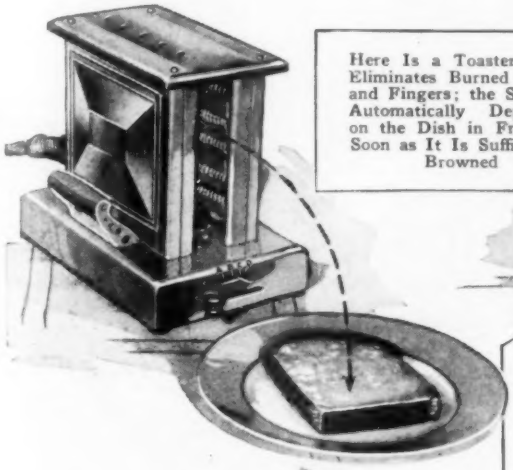
An End Table, Bridge or Luncheon Table Combined in One, Due to the Simple and Convenient Folding Top; It Is Adjusted as Shown Above at Right

This Coffeepot Calls You When It Boils; the Little Bird on Top Sings and Whistles Shrilly When Steam Is Up; Pot Is Filled Until Spout Overflows, Saving Need of Measuring

To Keep Shoes from Becoming Lost; the Trees Are Fastened Together and Both Shoes Are Lifted at Once with the Handle

Delicate Garments Are Not Injured in This Hamper, as It Has Smooth Inside Surfaces and Folds Up like a Book When Not in Use

Tasks a Pleasure



Here Is a Toaster That Eliminates Burned Bread and Fingers; the Slice Is Automatically Deposited on the Dish in Front as Soon as It Is Sufficiently Browned

Polishing Furniture with Paper; Simply Wad Up Two or Three Feet from the Roll and Use as a Cloth; the Paper Is Impregnated with Polish

This Skillet Has Grooves in the Bottom and Therefore Acts as a Grill, Eliminating Grease Fires and Holding a Chop or Steak Away from the Greasy Bottom; It May Be Used on Top of the Stove or in the Oven

At Left, a Convenient Squeegee Mop for Cleaning and Polishing the Floor, and, Above, a Fabrikoid Blanket Case in Various Colors and with an Interlocking Fastener at the Side; It Keeps Bed Clothing or Other Articles Free from Dust and Guards Them from Moths; It Is Made in Two Sizes

GIANT OF WORLD'S BRIDGES RISING IN NEW YORK

Artist's Drawing of the New Hudson River Bridge, Now under Construction, Compared with Other Famous Structures; Note Comparative Size of Brooklyn Bridge

Scheduled for completion in 1932, the new Hudson river bridge, now in course of construction between upper Manhattan Island and Fort Lee, N. J., will have a span of 3,500 feet, twice that of any suspension bridge heretofore built or under erection. Its mighty proportions dwarf every other bridge of its kind. The famous Delaware river bridge, for instance, has a span of but 1,750 feet and the Brooklyn bridge, the marvel of the age when it was built, stretches but 1,595 feet. Its floor is eighty-six feet wide, while the new bridge will have a roadway 118 feet in width. One of the interesting features of the mammoth new structure was the preliminary work done in testing the rock for the foundations. The services of a geologist were obtained in making extensive borings to a depth of 300 feet on the New Jersey side to make sure that the strata were of the proper character to support the enormous weight of the bridge tower. The huge cables are to be anchored to the rock on the New Jersey side, and on the New York side, they will be imbedded in an almost solid block of masonry, 290 by 200 feet square at the base and 130 feet high. It will rest on bedrock. It is estimated that more than 8,000,000 vehicles, 19,000,000 passengers and nearly 1,500,000 pedestrians will use the bridge during the first year. To finance the huge undertaking, bonds to the value of $60,000,000 were issued. It is expected that the toll charges eventually will pay for the bridge.

MAIL PLANES' TOTAL MILEAGE TWENTY-FOUR MILLION

Since February, 1926, the beginning of the air-mail service, United States mail planes have flown more than 24,000,000 miles, enough to girdle the earth about 1,000 times, according to post-office figures. The exact mileage up to May of this year was 23,760,017. During that time, over 10,000,000 pounds of mail was carried and more than $21,000,000 was paid to contractors. From nine routes, the service has extended to twenty-five. The longest is between Chicago and San Francisco.

¶A combination phonograph, radio receiver and clock, invented in Germany, speaks the full hours and utters such announcements as "Breakfast is ready," and "Time to go to school, children."

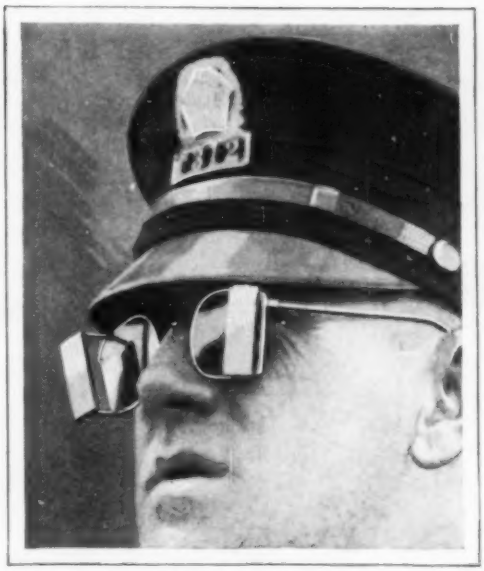
MYSTERY VEILS OLD PYRAMIDS FOUND IN MEXICO

Six more pyramids, recently unearthed along the "Pathway of the Dead" in the ancient city of Teotihuacan, have set Mexican and other archæologists to further investigations into the origin of the mysterious city, which is of unknown age and history. The Aztecs who met the Spanish conquerors in the sixteenth century could tell nothing of its beginning. The pyramids are small compared with those devoted to the sun and the moon, already unearthed, but remnants of old temple walls which once surrounded the pyramids, broken pillars and several of the central altars have been found. The arrangement shows that several of the temples must have had inner sanctuaries, entered through mazelike passageways. Concrete and stone-slab-covered drainage canals have also been found along the street, indicating that the inhabitants knew how to provide outlets for storms and high waters to prevent floods.

BICYCLE PEDALS ON PONTOONS OPERATE WATER CRAFT

Bicycling on the water has become popular at Florida resorts with a water craft which applies the principle of the bicycle to locomotion on water. Bicycle pedals and frame are mounted on two pontoons, the pedals operating a water wheel set between the pontoons, thus furnishing the motive force.

Carrying a Passenger on the "Water Bicycle," a Pontoon Affair Propelled by a Pedal-Operated Water Wheel



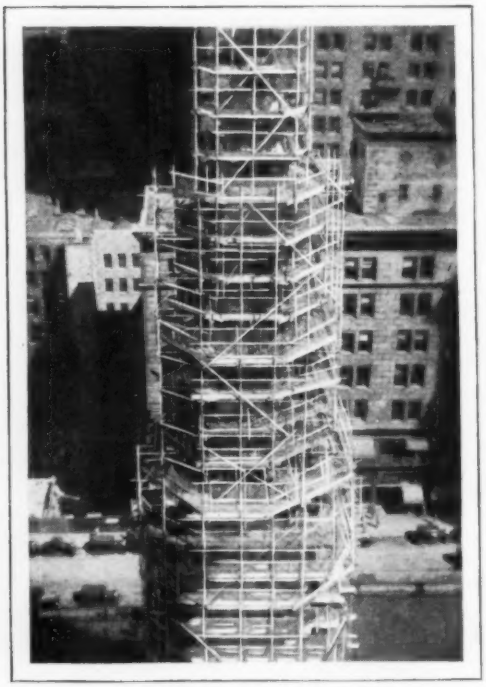
Traffic Policeman Wearing Goggles That Have Rear-View Mirrors Similar to Those on Automobile

REAR-VIEW MIRROR IN GOGGLES FOR TRAFFIC OFFICERS

To enable traffic officers to see what is going on behind their backs, the Boston police are experimenting with rear-vision goggles. The goggles, worn like ordinary spectacles, have mirrors placed at an angle in front of the lenses, thus giving the traffic officer an unobstructed view of what is going on in front of him and a good idea of what is happening behind.

WALKS OF COLORED CONCRETE LAID IN FANCY PATTERNS

Welded sheet-steel frames or stencils are being used in Germany in laying garden and park or other walks in patterned colored concrete. The frames, or forms, are ten by fifteen feet in size, with upright sides and interior divisions making a pattern of any design and for any number of colors. The form is set on the usual foundation and the colored concrete poured into the proper spaces until the whole frame is filled, when it is moved ahead. Two men can handle the frame and can lay 200 square yards a day.



Steeple of St. Paul's Church, New York, as It Appeared Surrounded by Scaffolding during Repairs

CHURCH PLACED IN STEEL CAGE FOR SAFE REPAIRING

To reduce the fire hazard and protect workmen and passers-by during the repairing of St. Paul's church, famous landmark of lower Broadway in New York city, the entire structure was inclosed in a steel-cage scaffolding. The cage is 200 feet high, and 5,000 couplings and 2,500 pipes were required to complete the frame.

FLY PLANE ABOUT WATERSPOUT TO MAKE MOTION PICTURES

For the first time in history, motion pictures have been taken of a waterspout from the air. A survey party of the National Geographic society was proceeding from Key West to Cuba in a large flying boat when a heavy squall, which developed into a waterspout, blew up a short distance from Havana. Jacob Gayer, staff photographer, and Capt. Albert W. Stevens, noted army photographer, seized cameras and for several minutes took movies and stills of the writhing column as the plane was flown around it as near as safety would permit. Frederick Simpich, in charge of the party, describes the spout as a "giant factory chimney, linking the heavens with the sea. As it grew in size and whirled and twisted, it took the shape and appearance of a great snake, spray and mist rising in clouds from where its tail lashed the sea. Yet its writhing edges were as clean-cut as a broad band of black ribbon. Gayer and Stevens made a series of pictures. First, they shot the straight dark descending line that marked the monster's formation; then its great twisting black bulk and finally, a long, grayish snakelike arm that swung off at forty-five degrees, its lower end now whipped out into thinning water strands. By my watch, it was exactly seven minutes from the time the spout first formed until it faded into the black depths of the moving squall."

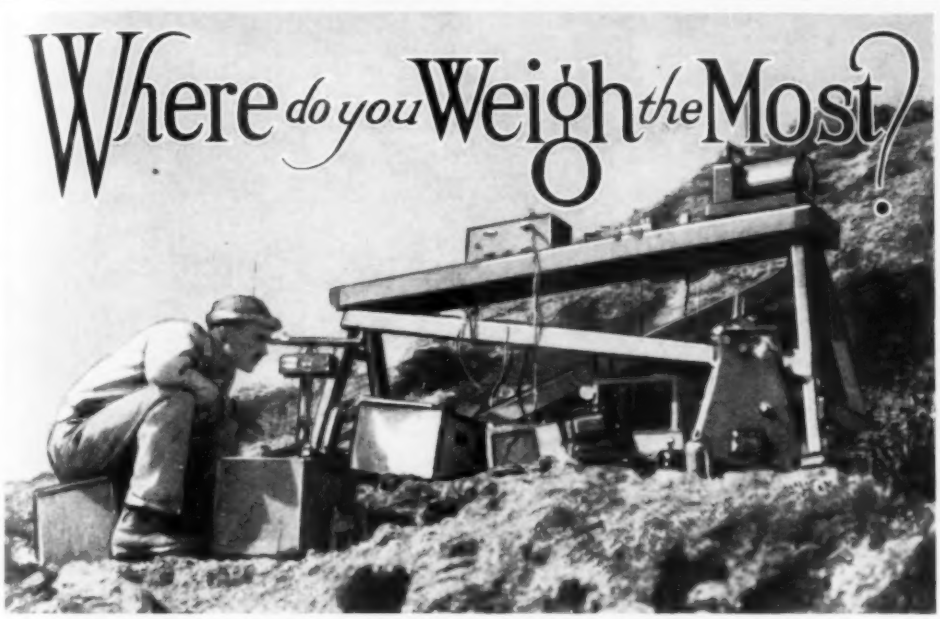
"MIKE" SWUNG ON SHOULDERS AIDS SPORT BROADCASTS

Radio announcers broadcasting sport and other events requiring some moving about, now are using portable microphones attached to their shoulders by a harness instead of being placed on a stand. The "mike" rests on the chest in a position similar to that of the mouthpiece of a headset telephone.

© Harris & Ewing

Broadcasting a Sporting Event through Microphone Supported on Shoulders Instead of Stand

Where do you Weigh the Most?



© Henry Miller

Government Engineer Making a Gravity Measurement on the Side of a Mountain; the Force of Gravity Differs in Various Parts of the World and Scientists Are Seeking a Master Standard or Average

By GEORGE W. GRAY

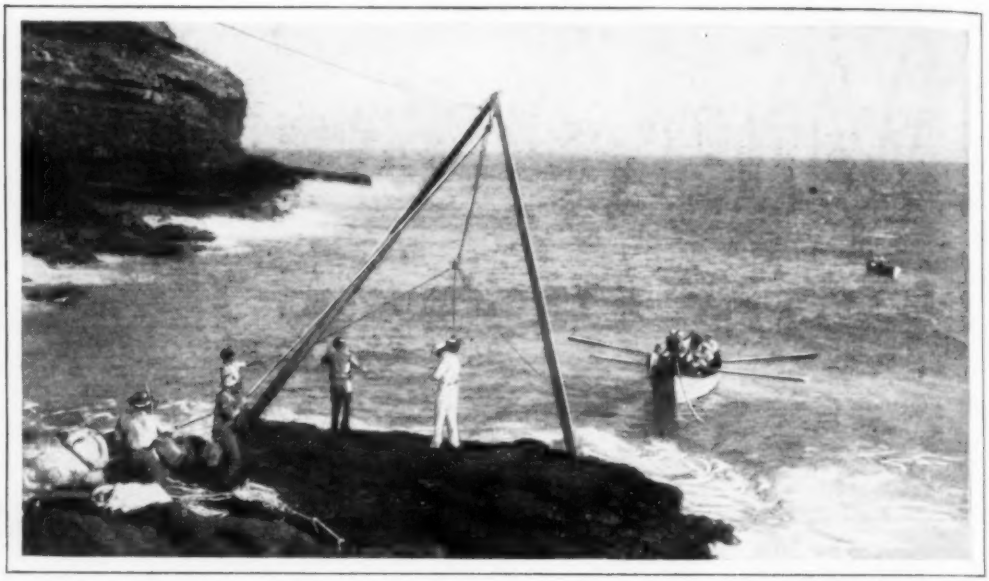
TO DETERMINE the force of gravity —the "pull" of Mother Earth—the bureau of standards has begun at the city of Washington observations and computations which will require more than three years to finish and thus to establish a world standard.

Why is such a measurement important? Because the gravitational survey of the earth, which is being carried on by the nations, requires some master value—just as the land surveyor must have a standard mile by which to rate his tape, and the chemist a standard gram by which to rate his scales.

It was in 1900 that the United States acquired its gravitational value from Germany. In that year, a representative of our coast and geodetic survey visited Potsdam, swung a pendulum there for a series of days, and determined its beat in relation to that of the official instrument. Returning to the United States, he swung the same pendulum on a pier in the basement of the survey office in Washington, and so rated the Washington value in terms of that at Potsdam. Since then, the gravity experts of the survey have year after year visited picked points in the United States, adjusted their delicate pendulum apparatus and swung it for twenty-four hours or longer—time enough to measure just how strong is the pull of the earth in that particular spot.

One party of observers took the instrument to the top of Pikes Peak and found that, of all places in the United States thus far tested, the force of gravity is weakest there. This is to be expected, for gravity diminishes with altitude—as one gets higher and therefore farther from the planet's center, the earth's attraction rapidly lessens.

The place in the United States where the force of gravity has been found to be strongest is a village in the northeast corner of North Dakota, the town of Pembina. Here the pendulum made 172,656 swings in twenty-four hours, whereas on Pikes Peak its beat was only 172,480 swings in the same period. The stronger the pull of gravity, the more



Landing the Apparatus for the Gravity Survey on Nihoa Island, Hawaii; Tests Have Been Made on Mountain Peaks, at the Equator and near the Poles, to Establish a Universal Gravity Standard

rapidly the pendulum vibrates. Gravity varies also with latitude. Thus, a pendulum clock which keeps correct time at New York will gain if moved to Labrador and will lose if moved toward Miami. A man who weighs 200 pounds in New York will weigh only 199 pounds ten ounces in Panama. The reason for these changes lies in the earth's rotation.

At the equator the speed of rotation is more than 1,000 miles an hour, whereas at Chicago it is only 772 miles an hour, and at the poles so slow as to exert no appreciable centrifugal force. It is this centrifugal force, which steadily increases as one approaches the equator, that overcomes gravity to a certain extent, and so cuts down weight, slows down the swing of pendulums, and causes clocks to lose time unless they are adjusted to the variation.

Mining prospectors, seeking mineral deposits, find in gravity variations an important signpost to hidden wealth. Many valuable deposits of oil, nickel, and other minerals have been found in this indirect way. Thus, petroleum deposits in southern Texas usually occur in connection with massive underlying domes of salt. A recent publication of the Colorado school of mines reports twenty salt domes discovered in Texas by gravity methods within seven years. Such discoveries require extremely sensitive apparatus, but they are a demonstration of the practical results that may come from such work.

A rather interesting outcome of the development of oil fields in the Panhandle district of Texas is the discovery of an unknown mountain—unknown because it lies buried hundreds of feet under the sand, clay and other sediment deposited here ages ago. No eye has seen the buried mountain; but scientists, feeling it out through their gravity instruments, know it is there—just as astronomers more than twenty years ago "felt" the planet "X," now named "Pluto," which was recently added to our solar system.

BLOSSOMS THREE FEET ACROSS FOUND IN SUMATRA

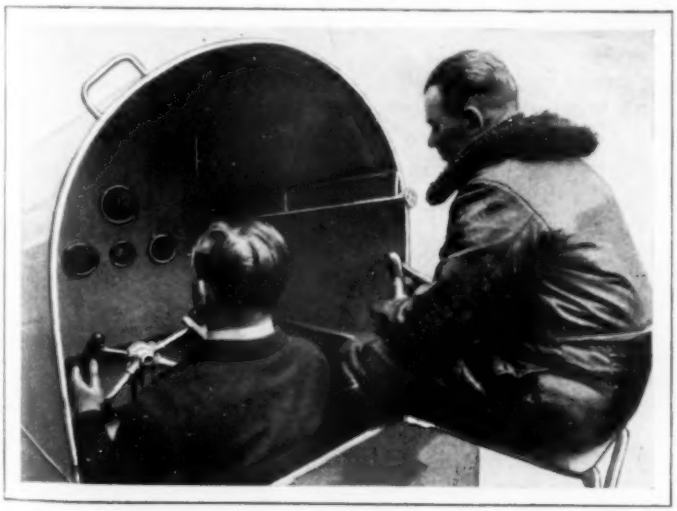
Blossoms of a plant found in the interior of Sumatra grow to enormous size, often reaching a diameter of three feet and more. The buds are only as large as walnuts and give no indication of their future proportions. Just before opening, they closely resemble a cabbage and the matured blossom is somewhat like the forget-me-not bloom. It has an unpleasant odor and, oddly enough, is usually found only along wild-elephant trails.

INVISIBLE RAYS MADE VISIBLE SHINING ON MINERALS

"Black light," the ultraviolet rays that cannot be seen by the human eye, is rendered visible when it shines upon certain minerals. This phenomenon is seen in the Academy of Natural Sciences in Philadelphia, where a case containing the minerals in a dark chamber and exposed to the rays is on display. Light from a carbon arc lamp is filtered, so that only the ultraviolet rays shine upon the minerals. Immediately they glow in beautiful colors, since the invisible rays are transformed into wavelengths that can be perceived by the eye. A switch is arranged to operate the carbon arc automatically and electric lights placed at intervals, so a constantly changing spectacle can be seen.

HOODED COCKPIT HELPS PILOTS IN BLIND FLYING

Blind flying, the art of governing an airplane by dependence on the instruments alone, which is often necessary in fog or adverse weather conditions, is taught student flyers of a Berlin aviation school in a special ship with a hooded cockpit. The hood shields front and side view from the student who is thus forced to rely on his instruments which are located on a panel in front of his eyes. The instructor sits alongside the student.



View of Hooded Cockpit of Plane Used to Teach Students to Fly through Sole Reliance on Their Instruments

Car Door Open to Show How Seat Swings Around for Easier Entrance and Exit

COACH CONVERTED INTO SEDAN WITH A MOVABLE SEAT

Converting a two-door coach into the efficiency of a sedan is made possible with an attachment for one of the front folding seats that enables the passenger in this seat to turn it toward the door so that other persons can enter or leave the car. It consists of a metal frame installed under the front seat and is equipped with an automatic device that locks and unlocks the seat with the opening and closing of the door. While it does not interfere with the tilting of the seat, this is unnecessary because the person occupying it does not need to leave the car to allow others to enter. It can be quickly installed and does not alter the car's appearance because it is under the seat.

¶Our Bureau of Information will answer all questions regarding articles appearing in this magazine.

LAWN FERTILIZER IS SPRAYED THROUGH GARDEN HOSE

Watering and Fertilizing the Lawn at the Same Time; the Jar That Holds Fertilizer Is near Nozzle

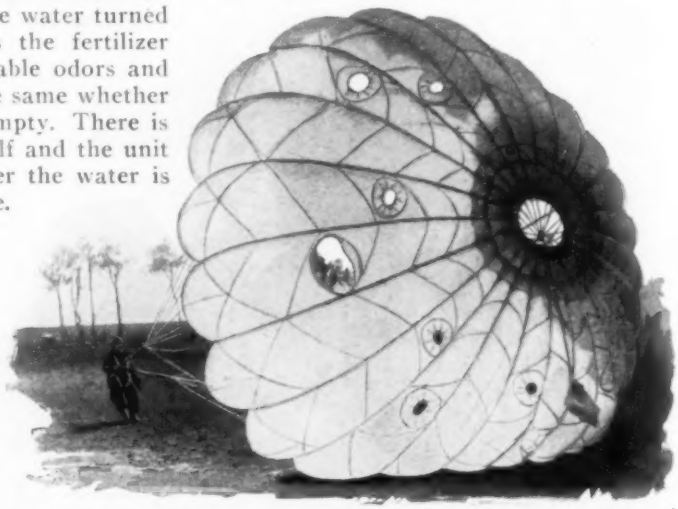
Applying chemical fertilizer to the lawn is simplified by a spray attachment which is fastened to the ordinary garden hose, the fertilizer being applied with the water, thus preventing danger of burning the grass, as the water carries the ingredients to the roots. An ordinary fruit jar is filled with the fertilizer and screwed to the top of the spray, which is then attached to the hose and the water turned on. The method spreads the fertilizer evenly, leaves no disagreeable odors and the proportions remain the same whether the jar is full or nearly empty. There is no pressure in the jar itself and the unit works equally well whether the water is under low or high pressure.

TEXTILES SORTED BY THE USE OF ELECTRIC EYE

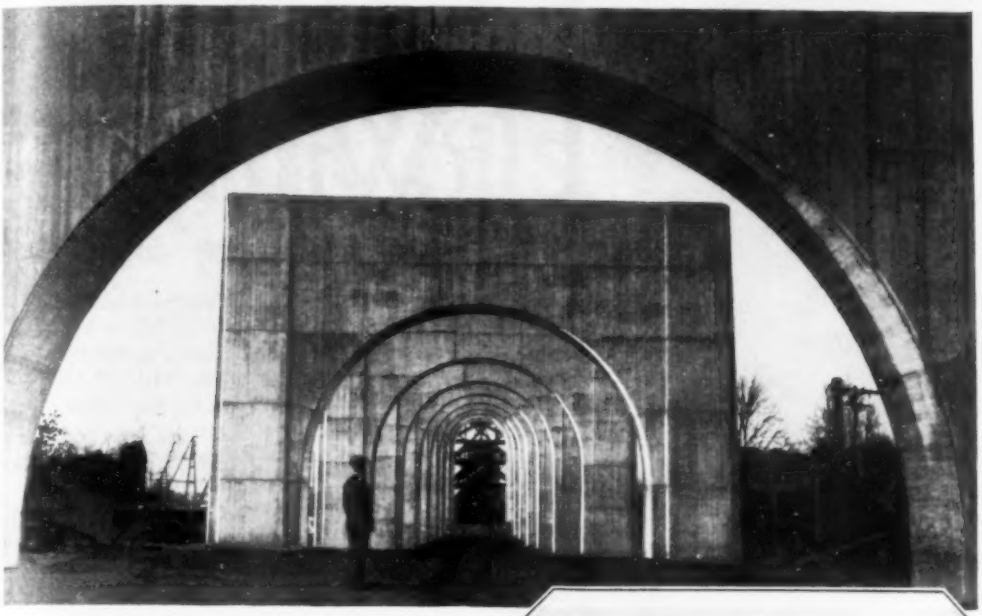
Textiles of slightly varying shades are classified more accurately than would be possible by ordinary inspection with the aid of the photo-electric cell, the efficient "electric eye" that science is harnessing to perform a number of important tasks. Two cells are employed in the textile-testing apparatus. They create a balanced circuit and hold an indicator needle at zero so long as both are receiving the same amount of light. But when the color of the sample under one cell differs even slightly from that of the sample under the other, the variation in light causes the needle to swing away from zero, and the inspectors know that the two materials are not exactly the same shade, although the difference may not be apparent to the unaided eye. The effects of weave and sheen, likely to cause errors in the judgment of the electric eye are overcome by rotating the cloth until the colors are melted into a solid mass of color and by using means for reflecting light from the cloth in all directions so that a concentration of light at any one point is eliminated.

PARACHUTE FOR SHORT JUMPS OPENS IN FEW FEET

Successful tests with a parachute that opens almost instantly and is safe for jumps from an altitude as low as ninety feet, are reported from Germany. The unit would be particularly serviceable in emergencies where many serious airplane accidents have occurred, and the ordinary type of parachute opens too slowly.



German Parachute That Is Said to Open So Quickly That Jumps from Altitude of Ninety Feet Would Be Safe



Concrete Arches and View of Partly Completed Span of the Kill Van Kull Bridge

WORLD'S LONGEST ARCH SPAN IN KILL VAN KULL BRIDGE

Kill Van Kull bridge between Bayonne, N. J., and Port Richmond, Staten Island, will contain the longest arch crossing when completed, with a center span of 1,675 feet. At the Port Richmond end is a long row of stately arches of concrete which will support the great steel framework and from which the big center span will launch itself across the water to the New Jersey shore. The bridge is to be finished some time during 1932.

ELECTRIC BRAKES FOR AUTOS ADD SAFETY TO DRIVING

Greater safety and increased ease in driving are among the advantages claimed for an electromagnetic braking system for the automobile. The brakes are operated by a pedal in the normal manner, but the operator, in depressing the pedal, simply turns on the current which does the braking, and the installation may be so adjusted that, if the car rolls backward on an incline, the brakes are set automatically on all four wheels. Operation of the system is simple. Energized by current from a battery, a magnet exerts a gripping action on an armature of the ring type, attached to a standard brake drum and revolving with it. When the brake band expands against the drum surface, no further rotation of the magnet is possible, so that the armature slips on the magnet facing, combining its retarding force with the magnet's, which continues its pressure against the brake band. As soon as the current is cut off by releasing the pedal, the entire assembly returns to neutral or off position. The action is the same whether going ahead or in reverse. The braking power depends on the amount of current that passes through the magnet and this is controlled by the degree of pedal depression.

From 15 *to* Without

PART I

THIS four-tube short-wave receiver has the punch and flexibility short-wave fans have been looking for, and, in addition, it is no longer necessary to shut off the set and take it apart in order to change from one wave band to the other. Although it does not employ plug-in coils, there has been no loss in efficiency, as coils of the good solenoid type have been retained. Four settings of the dial at the left on the front panel cover the entire short-wave range and bring in all short-wave stations, regardless of distance, at loud-speaker volume.

There are several other outstanding features that make this an unusually good receiver for general short-wave reception. It has been designed to use 224 a.c. tubes on a battery source of filament supply, taking advantage of the non-microphonic characteristics of these tubes in the r.f. and detector stages. These screen-grid tubes are followed by a two-stage transformer-coupled audio amplifier with a 112-A power tube in the last stage. The chassis construction is rugged and simple, and the completed receiver is well housed and shielded in a neat and simple sheet-aluminum cabinet, the construction of which will be described in detail in the October issue.

Fig. 2 shows the schematic circuit diagram and Fig. 3 the simplified wiring diagram, with all parts plainly marked. The various photos, together with the simplified wiring diagram make the building of this set very easy, and an enlarged diagram and a detailed material list are available to all.

The chassis is made from a sheet of No. 14 gauge brass, 12 by 17 in., cut with a hacksaw and bent as shown in Fig. 1. The large cut-out at the upper left is for the tuning unit which contains the rotating coils and is housed in a copper shield. This unit extends about 1 in. below the top of the chassis and is held in position by two small lugs at the front. After all cut-outs have been made, mark off and drill the mounting holes. This done, the metal sheet may be bent on the dotted lines to form the chassis. This is easily done by clamping the sheet in a vise, between two short boards, 1 in. thick, exactly on the bending line. Place a piece of thin board against the section to be bent and use a hammer or mallet to bend the sheet over at right angles, to form the supporting sides. These sides raise the chassis about 2 in., providing sufficient room for mounting the instruments on

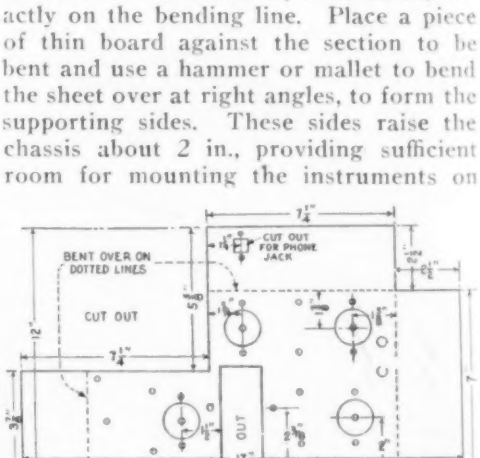
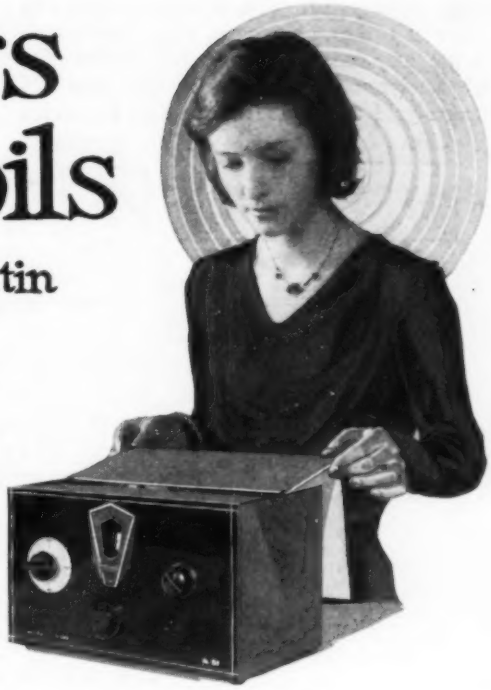


Fig. 1

195 Meters Plug-In Coils

by Frank L. Brittin



the underside. The sockets are the standard subpanel type and are mounted under the holes indicated by the circles, these holes being 1¼ in. in diameter and made with a fly cutter or by your local tinsmith. Mount the sockets with two short machine screws and take care that the contact-prong terminals are in the positions shown in Fig. 3. If the terminals are not marked on the socket, mark the chassis on the underside near each terminal with a pencil for identification and as a guide for wiring.

The small chokes are soldered directly to the terminals indicated. Note that the cathode terminals K on the 224-tubes are both at the same ground potential. That is, K of the r.f. tube at the upper left is grounded on the chassis at the dial-supporting bracket, and an additional lead is taken to K of the detector-tube socket which is also connected to negative-A in common with the grounded chassis. The terminal lugs on the tuner unit, conveniently located under the chassis, provide short sturdy soldering terminals to which the fixed condensers are soldered in order to make the shortest possible leads.

The a.f. transformers used are a small type and, when mounted on the underside of the chassis, extend just far enough down to provide additional support to reinforce the weak part of the chassis at the cut-out for the dial and tuner unit. The dial and condenser assembly is mounted on two small metal brackets screwed to the dial frame, using the top holes provided for the purpose. The rotor plates of the variable condenser must be grounded with a short lead directly to the chassis at the rear, a soldering lug being mounted on the chassis with a short machine screw for this purpose. A lead, taken from terminal G on the tuner unit, is run up to the stator plates of this condenser. The flexible leads to the top caps of the screen-grid tubes must be well insulated so as not to short on the chassis. The various battery-cable leads are made as short as possible and are soldered to the points indicated. Keep the A-leads together and cable the leads to the switch and volume control as indicated. The cabled battery leads are run out at the rear of the chassis through a hole insulated with a rubber grommet or cut large enough to prevent injury to the insulation.

The ½-amp. ballast to control the fila-

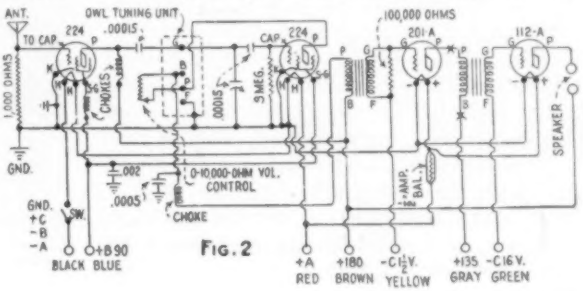
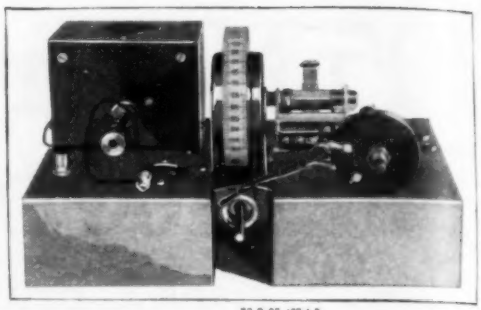


FIG. 2

ment supply for the 201-A and 112-A tubes in the audio stages, may be mounted at any convenient point under the subpanel near those tubes. The two 224 screen-grid tubes are connected in series



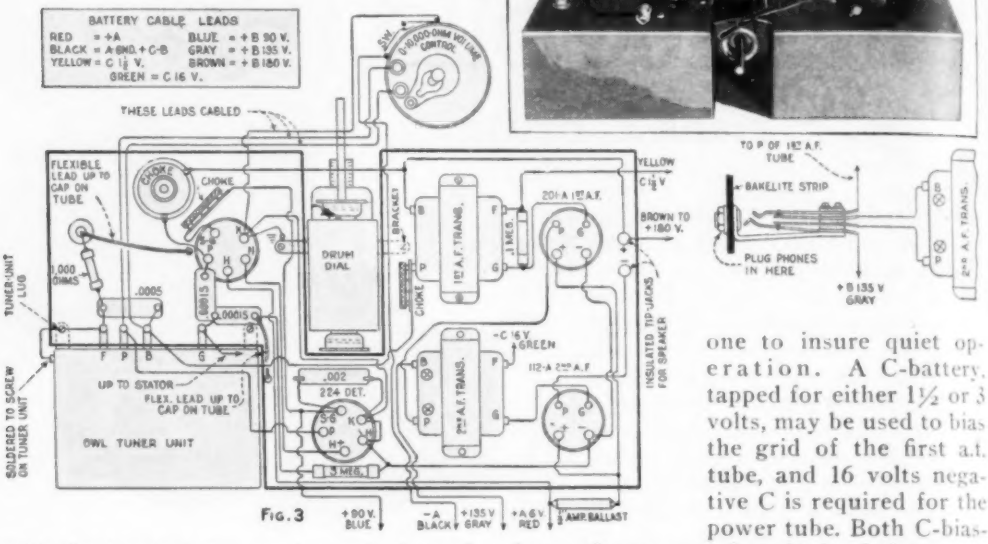


FIG. 3

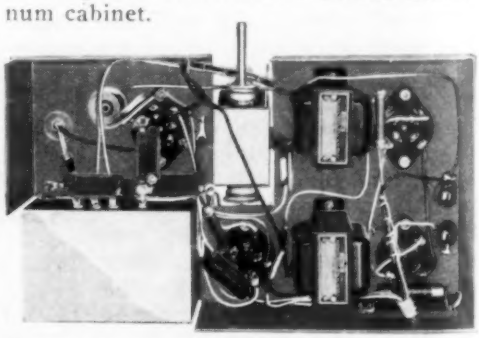
with the 6-volt A-battery instead of parallel, thus reducing the voltage to the tube specifications. Use insulated flexible wire for connections and solder joints.

To use phones instead of loud speaker, it is necessary to cut the hole indicated at the rear of the chassis and mount a two-circuit jack, preferably of the short or "gem" type, on a small strip of bakelite to carefully insulate it from the chassis. The connections for this jack are indicated at the points marked X in both diagrams, and the sketch at the right of the simplified diagram clearly shows the simple method of cutting the phone jack into the primary circuit of the second a.f. transformer, thus making the output of the first a.f. stage available for sufficient amplification and leaving all tubes in position. When phones are used, disconnect the loud speaker from the set.

When the wiring is completed, the set will appear as shown in the photo at the upper right on this page, and is ready for the tubes and power supply. The A-battery is the usual 6-volt storage type and the B-battery consists of four 45-volt units, connected in series for the 180 volts required, or a good B-eliminator may be employed instead, but it must be a good one to insure quiet operation. A C-battery, tapped for either 1½ or 3 volts, may be used to bias the grid of the first a.f. tube, and 16 volts negative C is required for the power tube. Both C-biasing voltages can be obtained from the usual 22½-volt tapped C-battery block.

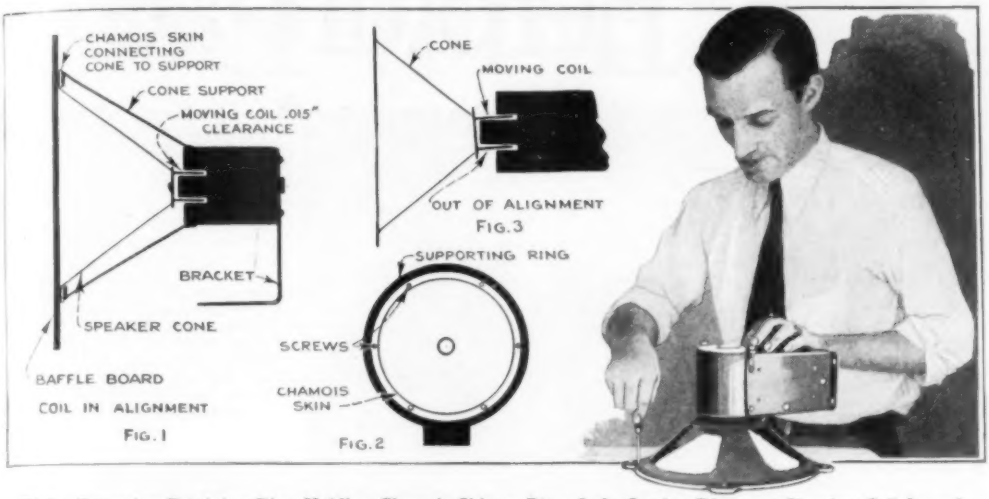
Place the tubes in the sockets and connect all batteries, and the antenna and ground. Almost any kind of antenna can be used, but for maximum DX and foreign signals a good outdoor type is required. Turn on the filament switch, which is operated by advancing the volume-control from the "off" position, and give the screen-grid tubes time to heat up to the operating point.

Tuning instructions, together with a log made in tests with this short-wave receiver, will be included in the article describing the construction of the aluminum cabinet.



Underside View of the Completely Wired Short-Wave Receiver

ELIMINATING THE RATTLE IN DYNAMIC SPEAKERS



Right, Removing Retaining Ring Holding Chamois Skin to Rim; Left, Section Diagrams Showing Coil In and Out of Alinement

By D. A. BROWN

AFTER the dynamic speaker has been in service for some time vibration will often appear. This can be traced to three causes: dirt between the field pole and moving coil, moving coil slipping from alinement due to excessive vibration, and a warped cone caused by moisture absorption and temperature conditions.

If there is no dirt between the field pole and moving coil, inspect the latter to see if it is out of alinement, as indicated in Fig. 3. This is a common trouble and can be remedied by restoring the alinement by the use of heavy paper as a spacer, as described later.

The third cause of rattles is due to the absorption of moisture by the chamois skin supporting the cone or uneven thickness of the skin, so that its pull on the edge of the cone is not uniform, and the cone comes at an angle to the field pole.

Upon removing the cone and examining the coil, places will often be noted on opposite sides where the winding is scraped bare of enamel; this denotes rubbing against the field coil due to misalinement. Give the moving coil a light coat of shellac to cover the bare winding and then reassemble the speaker.

Loosen all screws holding the chamois skin supporting the cone in order to realine the coil, as this coil moves with the cone. Wrap .015-in. thick paper around the coil, making only one turn and butting the ends together. This paper provides the necessary clearance between the coil and field pole.

Now assemble the remainder of the speaker and, when ready to tighten the chamois on the supporting frame, be very careful that the pull on the cone is uniform. Tighten one screw on the rim and then the one on the opposite side of the rim. While this is being done, keep slipping the paper up and down around the moving coil and note if it binds at any spot. If it does, loosen the chamois at the rim so that the binding will disappear. When the retaining ring has been tightened on the rim, remove the spacing paper and blow out any small pieces that may have been torn off.

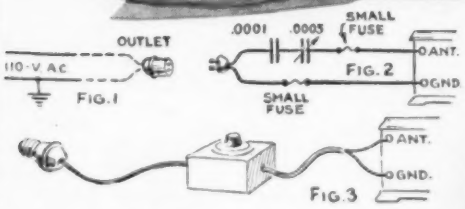
After the speaker has been assembled, paint the chamois with a small brush dipped in denatured alcohol; this will tend to tighten the skin uniformly. After the alcohol has evaporated, the speaker can be mounted on a baffle, as shown in Fig. 1, and tested, when the interfering vibrations should be at a minimum.

¶For further information on any radio construction article write to the radio department; this service is free.

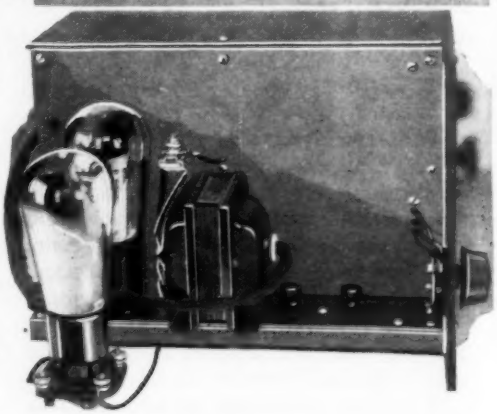
Helpful Radio

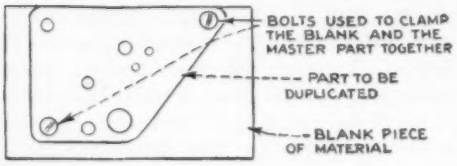
Turning a Short-Wave Receiver Correctly Comes Only with Practice; the Most Important Dial or Knob Is the One That Controls the Regenerative Detector; Keep the Detector in a Continual State of Oscillation by Turning This Knob Back and Forth as You Turn the Tuning Dial a Fraction of a Degree, Resting the Forearms on the Table

Below, to Increase the Current and Voltage Output of a Power Supply Employing a Type-280 Rectifier Tube, Use Another Tube of the Same Type and Parallel the Filaments and Plates of These Tubes with Flexible Leads; This Is, of Course, a Temporary Arrangement Applicable When the Rectifier Tubes Decrease in Efficiency

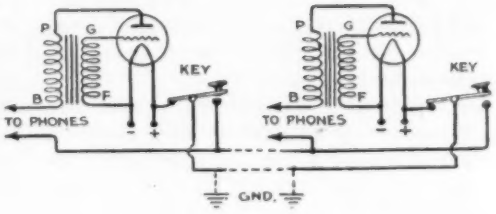


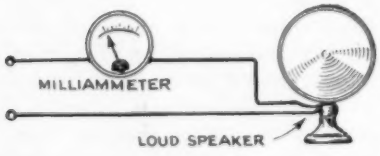
A Handy Substitute for Antenna and Ground When It Is Not Practical to Make the Usual Installation; Figs. 1 and 2 Show Details and Fig. 3 Suggested Assembly



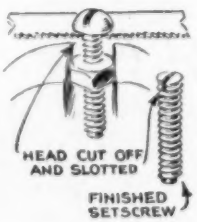


A Method of Quickly Duplicating Form and Drilling of Odd-Shaped Parts; One Edge of the Blank Is Lined Up with the Master Template and Clamped to It for Drilling, a Scriber Being Used to Outline the Shape of the Part; after Drilling, Clamp the Blank in a Vise and Cut on the Scribed Lines with a Hacksaw; Below, an 0-to-20 Milliammeter Used to Determine Correct C-Bias on the Power Tube; If Needle Drops Back with Signal, Increase C-Bias or Decrease B-Voltage



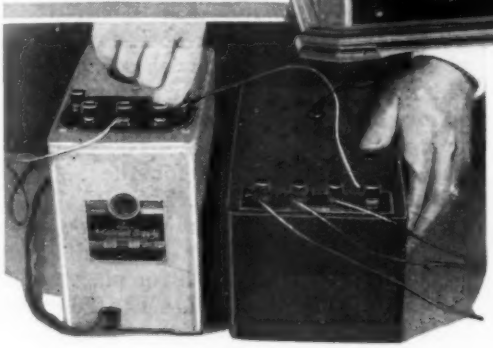


Above, a Two-Way Code-Practice Hookup Operated at Each Station with Either a 201-A Tube and a 4½-Volt C-Battery or a 199 Tube and Two Dry Cells; Right, Setscrews for Dials Made by Cutting Off the Head of Machine Screws of the Same Size and Thread and Slotting the Top with a File or Hacksaw



Hints and Kinks

Right, Pasting the Schematic Diagram of the Receiver in the Lid of the Cabinet Enables the Owner Quickly to Check the Receiver When Things Go Wrong; Below, Two B-Eliminators May Be Connected in Series to Obtain a High-Voltage Supply, the Positive Terminal of One Eliminator Being Connected to the Negative of the Second; the High Voltage Is Obtained from the Negative of the First and the High-Voltage Tap of the Second



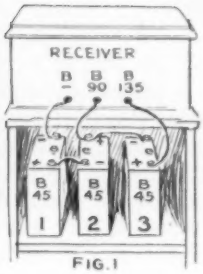


FIG. 1

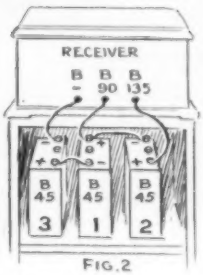
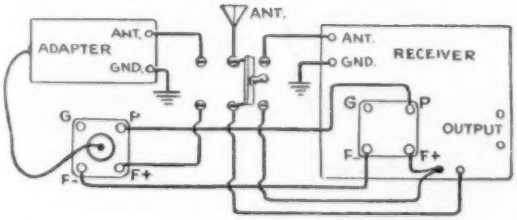
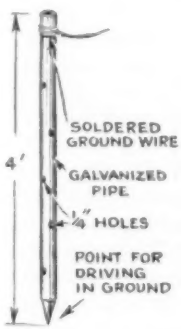


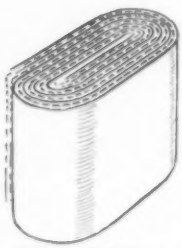
FIG. 2

Above, to Extend the Useful Life of B-Batteries, Shift Them, After the Volume Begins to Drop, from the Position Shown in Fig. 1 to the Arrangement in Fig. 2; the Drain Is Greater on the Detector 45 and 90-Volt Taps Than on the High or 135-Volt Tap; Below, By-Pass Condensers Are Made in Two Types, as Shown; of These, the Inductive Type Should Not Be Used in Modern Short-Wave Hookups, the Non-Inductive Variety Providing the Shortest Path to Its Terminals

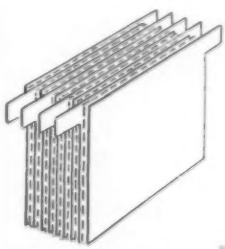




Above, for Quickly Connecting a Short-Wave Adapter to a Broadcast Receiver, the Adapter Plug Is Placed in a Spare Socket, the Wire Normally Connected to the Positive Filament of the Broadcast Detector Socket Being Disconnected and Extended Directly to the Switch Lever; Another Positive Lead Is Taken from This Socket to the Switch Terminal at Right, and the A-Supply May Then Be Thrown to the Broadcast Detector or S-W Adapter at Will; Left, Galvanized Pipe, Prepared as Shown and Filled with Salt, Makes a Good Ground



INDUCTIVE TYPE



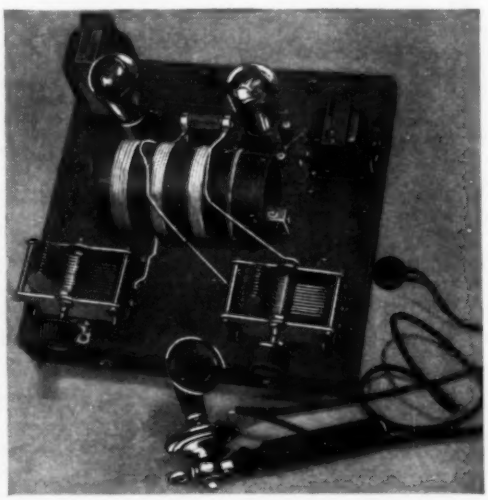
NON-INDUCTIVE TYPE

Low Cost of this Simple

THE COMBINATION phone and key transmitter described in this article is especially designed for the many would-be "hams" who have been unable to join the amateur ranks because of limited funds. It is a simple but efficient low-power apparatus, which, if made from standard parts of good manufacture, need not cost over $20 and can even be built for one-half that amount. In either case the price, of course, does not include antenna, power supply, microphone or tubes. With tubes of 199-type and only 45 volts on the plate, the transmitter will cover two miles easily on the phone and much farther with the code key. The range may be extended by using 201-A tubes with 90 volts on the plates or type 112-A tubes with 135 volts; in fact, the instrument has been designed so that any tube up to 5 watts may be employed. The filament voltage is supplied by dry cells or a storage battery, and the plate voltage by B-battery or a B-eliminator; the only change necessary being the increased power for the larger tubes.

The builder must first decide on which of the amateur bands he wishes to operate. This transmitter is built with fixed coils, although, if desired, the mountings may be made interchangeable. The 80-meter band requires 10 turns for the antenna coil, 7 for the grid coil, 7 for the plate coil, and 2 or 3 for the microphone coil; the 40-meter band requires 5 turns for the antenna coil, 3 for grid, 3 for plate and 1 for the microphone coil. The 80-meter band is most desirable for the beginner so this model was built for that band. The coils may be wound on cardboard or bakelite tubing, which should be 3 in. in diameter and 5½ in. long. A space of about ½ in. is allowed between all coils. The form should be drilled and wire threaded through it and anchored at convenient points to be soldered. No. 16 d.c.c. wire is used for all coils, and the connections below the base are made with No. 14 tinned-copper busbar wire.

The r.f. choke, consisting of 125 turns of No. 30 d.c.c. wire, is



Completed Short-Wave Radiophone with Hand Microphone Plugged in at Phone Jack No. 2

is Feature Radio Phone

wound on a ½-in. wood dowel, about 3 in. long, as shown in Fig. 2, and is mounted directly on the .006-mfd. fixed condenser on the underside of the panel by means of a brass machine screw to which one end of the choke winding is soldered.

The transmitter may be used as a single-tube set by simply leaving out the modulator tube, microphone transformer and 30-henry choke, as indicated in the schematic diagram. In this case, the microphone is plugged directly into the 2-turn coil jack No. 1 for voice. The closed-circuit jack is the code-key jack, and No. 2 is the microphone jack when two tubes are used as shown in the photo of the completed job. Two tubes give much better modulation and also more reliable transmission on the phone.

The assembly is very simple, as shown in Fig. 1, and large diagrams are available for those who wish them. The base panel is bakelite, ⅛ by 12 by 12 in., but may be dry plyboard if desired. This panel is supported by one bakelite strip, 3/16 by 2 by 12 in., and one strip, 3/16 by 2 by 11 13/16 in., the two forming the front and right sides of the base. The other two sides consist of wood strips, one of which is ¼ by 2 by 11 13/16 in. and the other ¼ by 2 by 11½ in. The base is now assembled with wood screws and short metal brackets for the bakelite sides.

Mount the two variable condensers and coil on short angle brackets. The jacks are the short gem type and the closed-circuit jack is wired as shown in the insert in Fig. 1. A small 6-volt flashlight bulb is mounted in a pilot-lamp socket at the left of the coil form, and its brilliancy indicates the amount of antenna current.

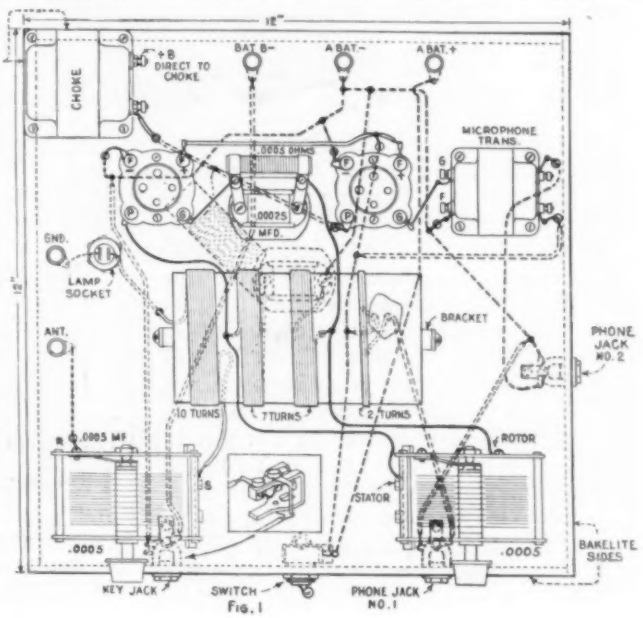
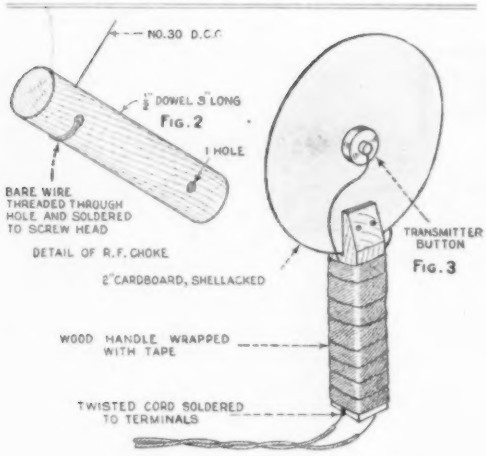


Fig. 1



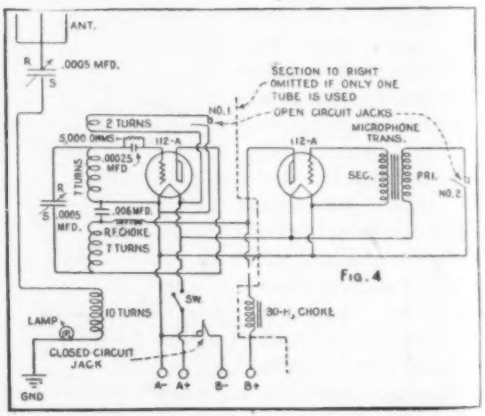
The transmitter must be tuned somewhere between 84.5 and 85.7 meters for use with phone. The wavelength should be checked with a wavemeter, or by listening to other amateurs and locating the position of the phone band on the dial of your short-wave receiver. Then, by tuning your own transmitter to the middle of the band, you are sure of being within the required limit.

The microphone shown in the photo on page 478 is a standard band type, but for those who would like to make a fairly good substitute, one of the small inexpensive microphone buttons may be mounted and wired as shown in Fig. 3.

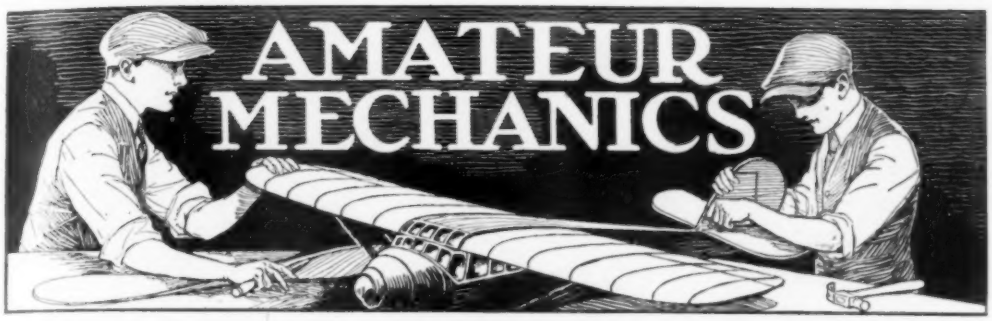
If the bell-ringing transformer is used as a microphone transformer, the results will be fair, but not nearly as good as with a standard transformer built for the purpose. These transformers are not expensive and may be had for very little more than the bell-ringing type. The key may be an inexpensive navy type connected by means of flexible leads to an ordinary horn plug for quick operation.

The tube sockets are then screwed to the panel, and the gridleak and condenser are mounted between them. The 30-henry choke at left rear is a manufactured type, but the secondary of a Ford spark coil can be used for 5-watt tubes, if desired. The microphone transformer is also a standard make, but those who wish to economize will find an inexpensive bell-ringing transformer satisfactory for the purpose. These substitutes are given in the material list, which is available to all.

Any antenna will work for a short distance, but if real efficiency is to be obtained, one must be constructed for the particular wavelength selected. For 80 meters an antenna about 132 ft., including lead-in and with a good ground connection, will give good results. The binding posts at the rear are for the power and filament supply, and the high-voltage B-lead goes directly to the binding post on the 30-henry choke. If only one tube is used and the choke omitted, it will be necessary to provide a binding post for this lead.



Top, Details of R.F. Choke and Homemade Microphone; Center, Assembling Parts; Bottom, Schematic Diagram of Complete Two-Tube Transmitter

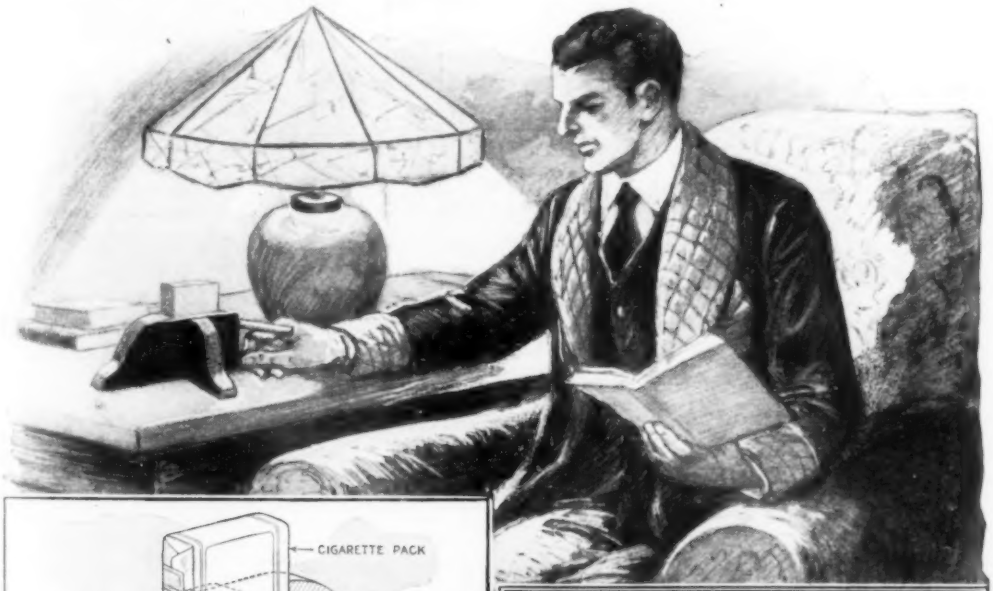


Unique Holder "Shoots" Cigarets

By KENNETH MURRAY

YOU press the button and the holder does the rest with the novel arrangement shown in the accompanying illustrations, giving automatic delivery of a cigaret direct from the original pack, which rests on top; a cigaret which is never touched by human hands until it is projected into the hand of the prospective user.

Five wood parts and the cable release from an old folding camera make this attractive holder. The block A, on which



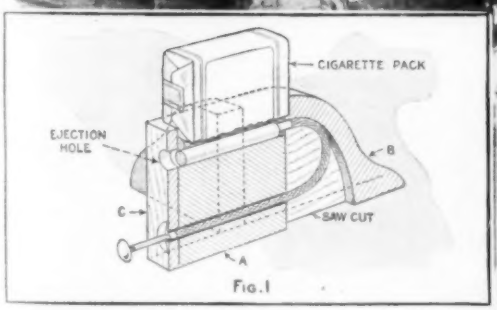
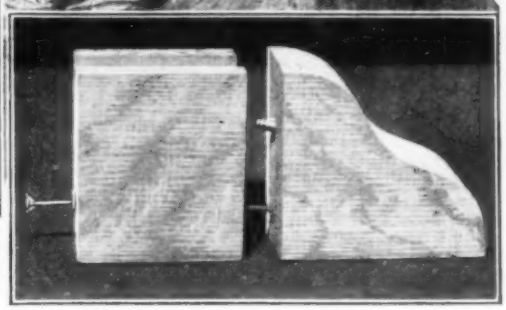
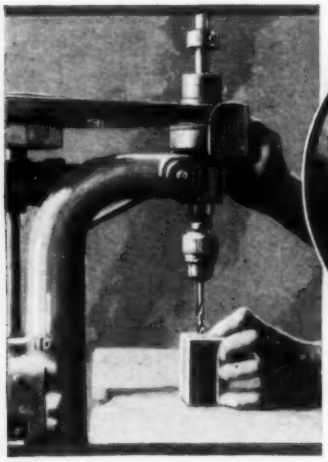


FIG. 1



A Push on the Button and Out Jumps a Cigaret! This Unique Cigaret Holder Is Extremely Simple and Easy to Make



Countersinking the Inside of the Ejection Hole in Block C with a Knife

The Hole for the Cable Release May Be Drilled through Blocks A and C at the Same Time, as Shown Above, Using a Hand Drill if a Press Is Not Available

Above, Cutting the Semicircular Groove in Block B on the Circular Saw; Below, Placing an Opened Pack on the Ledge in the Groove

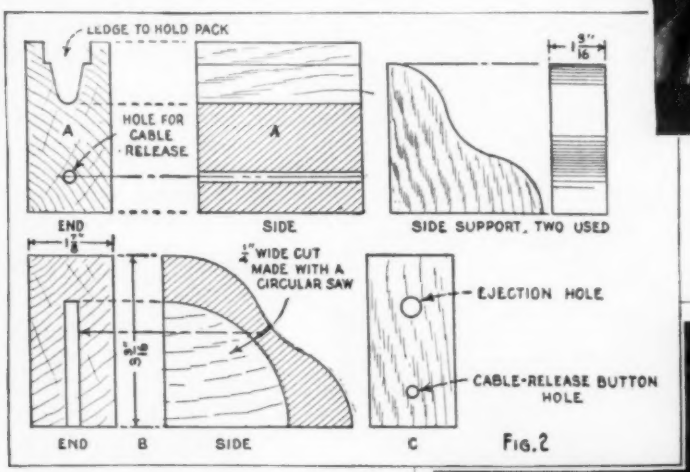


FIG. 2

the pack rests, is 2 13/16 in. long, 3 9/16 in. high and 1 7/8 in. thick. A tapered, round-bottom groove, 1 1/4 in. deep, to fit a cigaret as it drops from the pack, is cut along the top of this block, then ledged to support the pack, and 3/4 in. up from the bottom, a hole is drilled parallel with the groove to pass the cable release, as shown in the sectional drawing. Block B, which is 3 9/16 in. long and the same height and thickness as block A, is then cut to shape and grooved on the circular saw as shown in one of the photos, so that the cable release

will curve around and its end will just meet the groove in block A when the two blocks are placed together. Block C is ¼ in. thick, as wide as A is thick, and is fastened to the front of the latter. Cable-release and ejection holes are drilled in this block as shown, the inside of the ejection hole being countersunk with a knife so the cigarets will enter it easily. The side-support blocks are 2½ in. long, 2¾ in. high and 1⅛ in. thick.

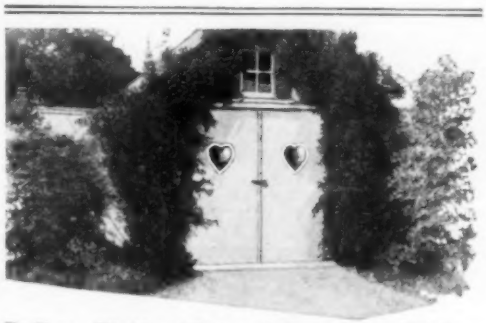
After all the parts have been cut out to shape, and all the necessary holes drilled, they are well sanded. The cable release is then installed. This should be of such length that it will just pass through blocks A and C, curve around in the groove in B and meet the groove in such a position that pressure on the button will eject a cigaret lying in the groove. When this has been checked, the parts may be glued together and finished.

Any wood that will take a good finish may be employed. A walnut stain was used on the holder shown, followed by an application of furniture wax. Of course, it is not necessary to stick closely to the design shown; it may be modified in any way, and the finish may be in either stain and varnish, lacquer or enamel.

To load the holder, all that is necessary is to tear the side from a standard pack, as shown in one of the photos, and drop it, open side down, on the ledge in the groove. A "cig" then drops to the bottom of the groove, and is ejected by a push on the button.

Ornamental Windows for Garage Doors

Many garages can be greatly improved in appearance by simple methods as shown in the photo. In this case the doors were of the plainest type without windows, and the owner therefore made fancy cut-outs, which he backed with glass, forming small heart-shaped windows. Trellises and climbing vines are also used for the same purpose.



Trellises, Climbing Vines and Fancy Door Windows Improve Appearance of This Garage

Paper Box on Bedpost Holds Clock

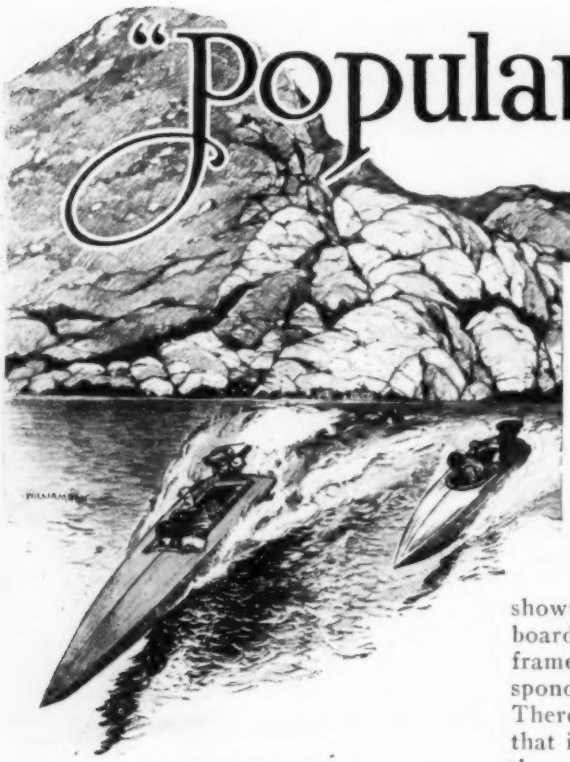
In order to have the alarm clock handy while in bed, a paper box was cut as shown in the drawing. A triangular hole

Paper Box Holding the Alarm Clock in Convenient Position on Bed

and a slit were cut in the back as indicated, so that the box could be attached to one of the vertical bars of the bed, which was done by gently springing the cardboard around the bar. The slit was later sealed with a strip of gummed paper as indicated in the detail. A circular hole was cut in the front of the box, to make the face of the clock visible. Due to the weight of the clock, the sides of the triangle grip the bar and hold the box in any desired position. When necessary, as when making the bed, slide the box up toward the top of the bar where it will be out of the way. If desired, the outside can be covered with colored crepe paper or cretonne.—Cecil Jones, Mount Vernon, Ohio.

¶To bleach a stain in wood, sandpaper the work and apply a mixture of fresh lime, 7 parts, and caustic soda, 1 part.

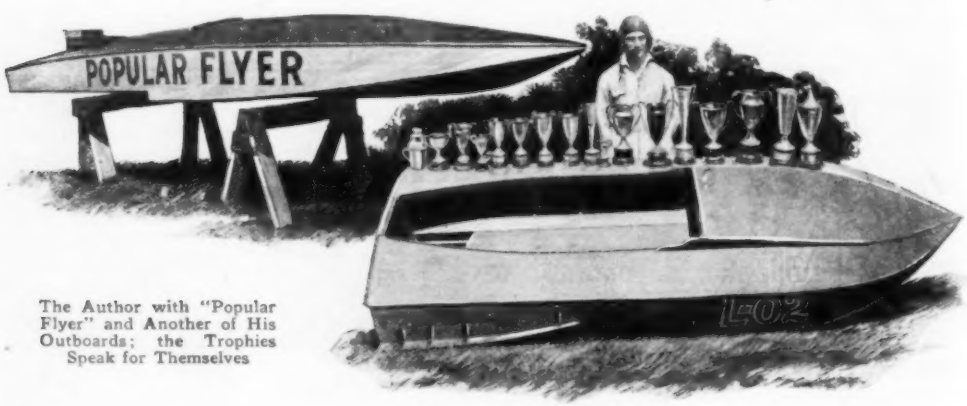
"Popular Flyer"—



By L. J. GORENFLO

SPEED is the outstanding feature of the "Popular Flyer," which was designed and built especially for Popular Mechanics along the same lines as the trophy-winning model shown in the lower photo. Every step in the construction of the boat is clearly shown so that you will have no difficulty in building a similar one. The craft may be built of cypress, mahogany or Washington red cedar.

The hull is built upside down on a long 2 by 12-in. board, called the keel-support board, shown in Fig. 1. It stands on two 3-ft., 2 by 4-in. legs, and is notched to receive the frames. The width, depth and spacing of the notches are given in Figs. 2 and 4, the former being a detail of the notch for the step. The frames, which are ½ in. thick, are assembled as shown in Fig. 7, and also the 1-in. sternboard, according to Figs. 6 and 13. Each frame is numbered, as well as the corresponding notches in the keel-support board. There are only three after-plane frames, that is, those between step and stern, but there are four half frames which are spaced equidistantly between the after frames. Dimensions of the half frames are also given in Fig. 7, all four being exactly alike. At the center of the bottom edge of each frame and half frame, a notch is cut to receive the keel. The dimensions of the forward and after keel are given in Fig. 1, which also shows how they are laid in the center notches of the frames. The bottom of the notches in the frames should come flush with the edge of the keel-sup-



The Author with "Popular Flyer" and Another of His Outboards; the Trophies Speak for Themselves

a Racing Hydroplane

port board, which is aided by the use of wedges as shown in Fig. 3. Fig. 10 shows how the keel is laid in a frame notch, the dotted lines indicating where the keel is planed down to the same angle as the frame. Fasten the keel to each frame with two 1¼-in. No. 6 flat-head brass wood screws. The best method of laying the keel is to start at the step, to which both forward and after keel are screwed, and then work toward the stern and bow, cutting the notches as you go along. As the forward keel comes to the bend, it should be temporarily fastened down to the support board with screws, spaced about 8 in. apart. The keel-support board is cut off at the bow 2½ in. from the end, as shown by the shaded section in Fig. 4, and a 1¼ by 4 by 6-in. nose block is fitted to the end of the keel. The dotted line X in detail A, Fig. 9, shows how the block is cut to fit against the end of the support board, and details B to D show how the block is tapered to fit the keel. Use brass screws to fasten keel to block.

The chines are next. These are the strips shown in Fig. 8,

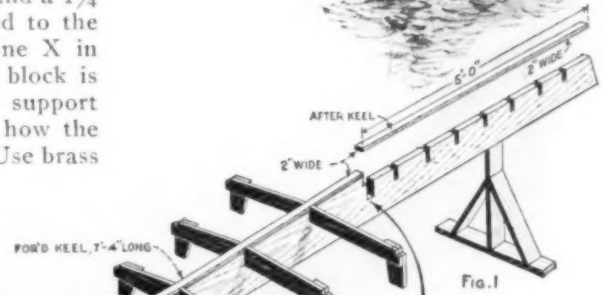


Fig. 1

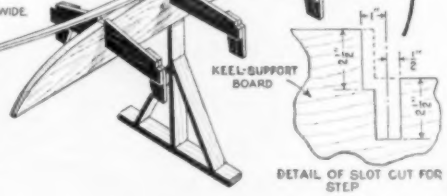


Fig. 2

Fig. 3

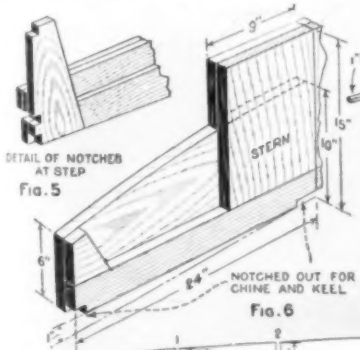


Fig. 6

Fig. 5

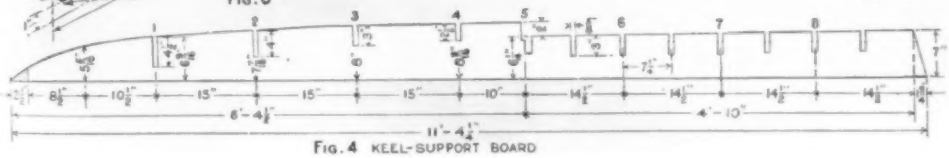


Fig. 4 KEEL-SUPPORT BOARD

Sawing the Nose Block at the Stem to Conform to the Sides

which are recessed into notches cut at the corners of the frames, at the junction of side and bottom. The after chines run from the sternboard right through the step and fasten to frame No. 4. The forward-plane chines are laid in the same way, running from the step to the bow. They are bent in forward and fastened to the nose block as indicated in Fig. 11, the end being cut off at an angle to fit. The projecting ends of the chines are shaved off to the proper angle before the bottom planks are fitted. The small end of the tapered forward chine is fitted to the step and the large end at the bow, so as to leave enough stock for beveling off.

The deck-line battens, ¼ by 1¼ in., are next fitted. These run along the upper ends of the frames and form the contour of the deck. They are carefully notched into the frames to lie flush. When these are in place, nail temporary props, as indicated in Fig. 17, to the ends of each frame and the sternboard, to level up the whole boat, taking care that the props are the same length on each side. Saw off the forward end of the keel as shown in Fig. 12, to conform to the shape of the boat's sides.

Clamp a 5/16 by 10-in. by 12-ft. plank on one of the sides, as shown in the photo on page 487 and mark with a pencil along

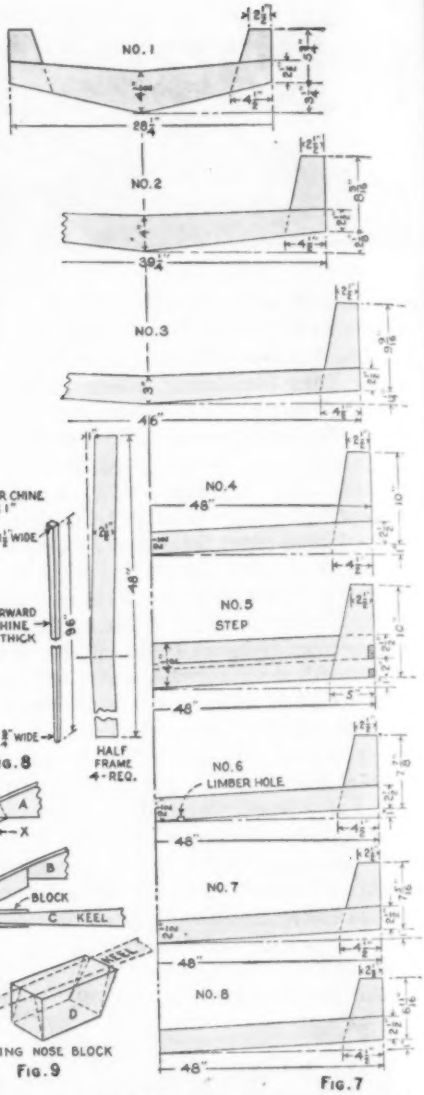


Fig. 7

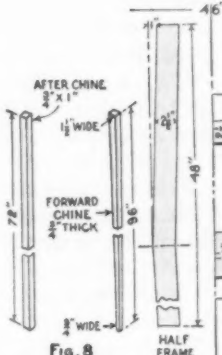


Fig. 8

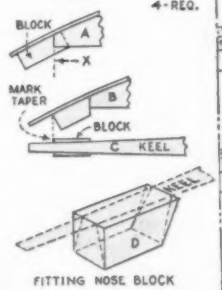


Fig. 9

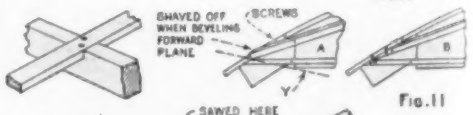


Fig. 11

Fig. 10 Fig. 12

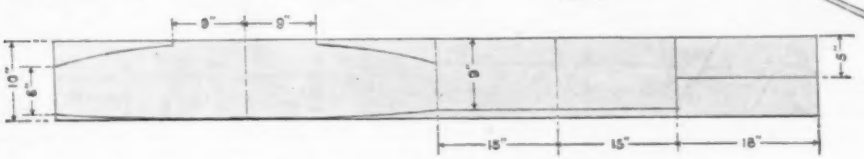


Fig. 13 How stern is cut from 8-ft. board

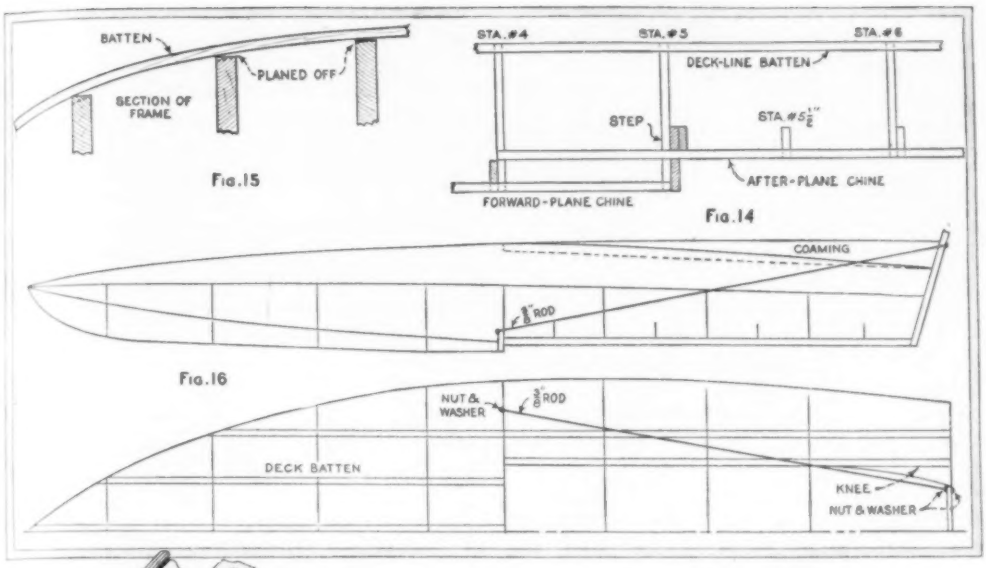


Fig. 15

Fig. 14

Fig. 16

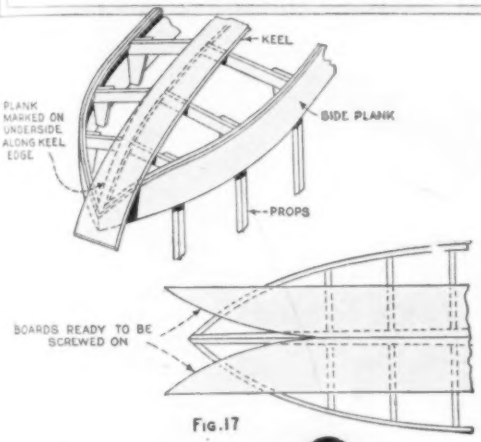
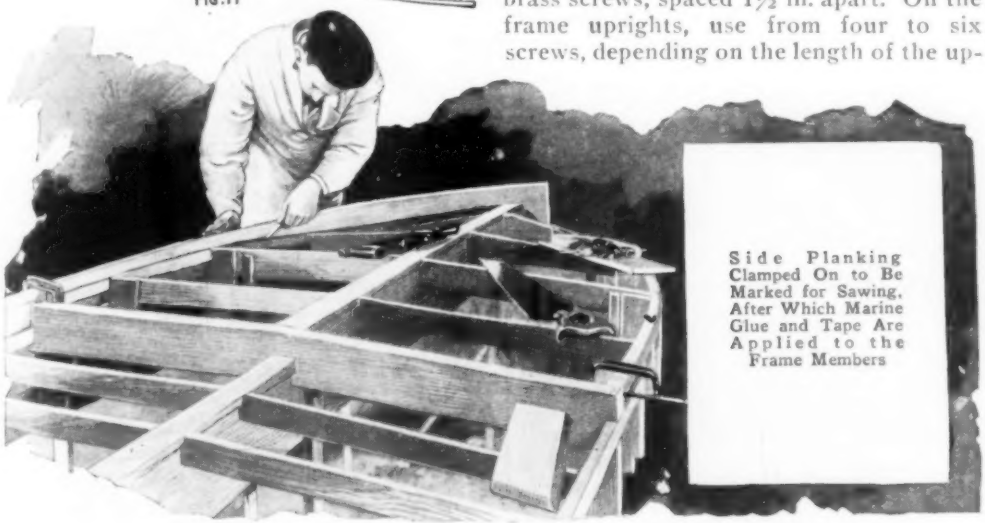


Fig. 17

the outer edges of the chine, deck line and sternboard. Remove and saw to shape, leaving about ¼ in. outside the line so as to be sure of having wood enough to plane smooth after the sides are fastened in place. Now apply heavy marine glue at all points on the frames, chines and sternboard that will be touched by the side planks, and lay a piece of ¾-in. white-cotton tape along the chines, deck-line battens and sternboard edge. This serves as calking, and is essential. Clamp the side planks in place again, and fasten along the chines with a staggered row of ⅞-in. brass screws, spaced 1½ in. apart. On the frame uprights, use from four to six screws, depending on the length of the up-



Side Planking Clamped On to Be Marked for Sawing, After Which Marine Glue and Tape Are Applied to the Frame Members

right. The screws on the edge of the sternboard should not be more than 1 in. apart, and should be driven in a double row.

Cut limber holes in each frame, as shown in frame 6, Fig. 7, to allow any water that might get into the boat to run to a place where it can be removed easily. Start planking the after plane with 5/16 by 8-in. boards, one on each side of the after keel. These are known as the garboard strakes. They butt together over the flush keel, and the planking is continued out to the sides with 6-in. planks. The position of the planking joints is marked on the frames before fastening down, the planks removed, and a 1/4 by 1 1/4-in. batten sunk into the frames directly under the seam line, as shown in Fig. 18. Each plank is fastened with screws, staggered 1 in. apart, on the sternboard and with at least four screws to each frame. The battens are clinched to the board with 1-in. copper nails, 2 in. apart, and the same fastening and spacing is used on the keel. The nails are clinched over firmly on the inside.

Before planking the forward plane the chines and frames must be beveled. Take a long thin batten, about 4 in. wide, and lay it down on the forward frames, parallel to the keel. By bending this batten down on the frames, as shown in Fig. 15, it will be seen how much should be planed off the forward edge of each frame member so that the planks will lie flat to the surface of the frames. Start planing close to the keel, on each side, checking carefully with the batten and moving the batten outward as you plane, until you come to the chines. The latter must also be planed off so that the bottom planks will lie perfectly flat on them and with a good bearing.

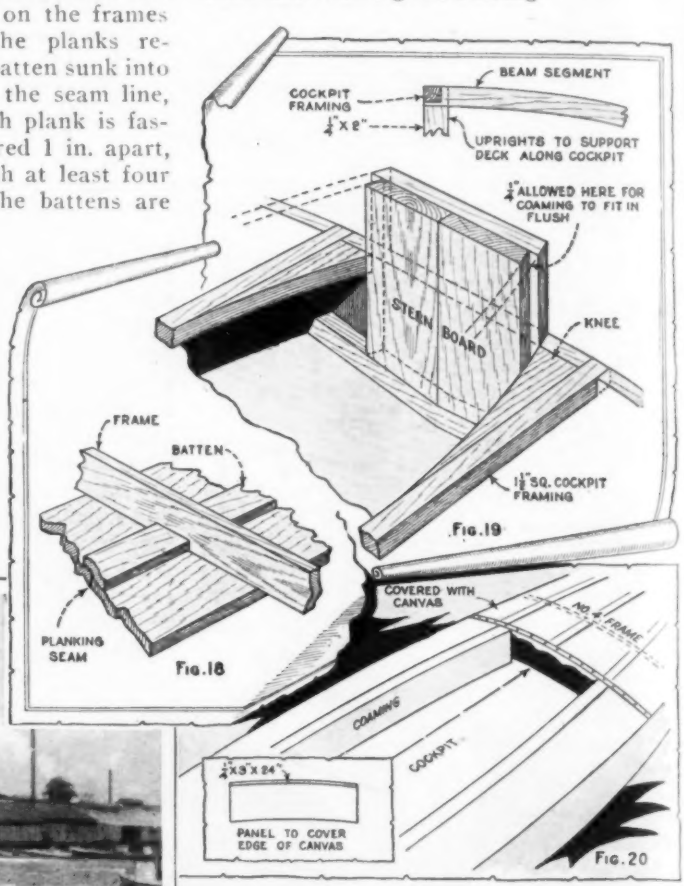
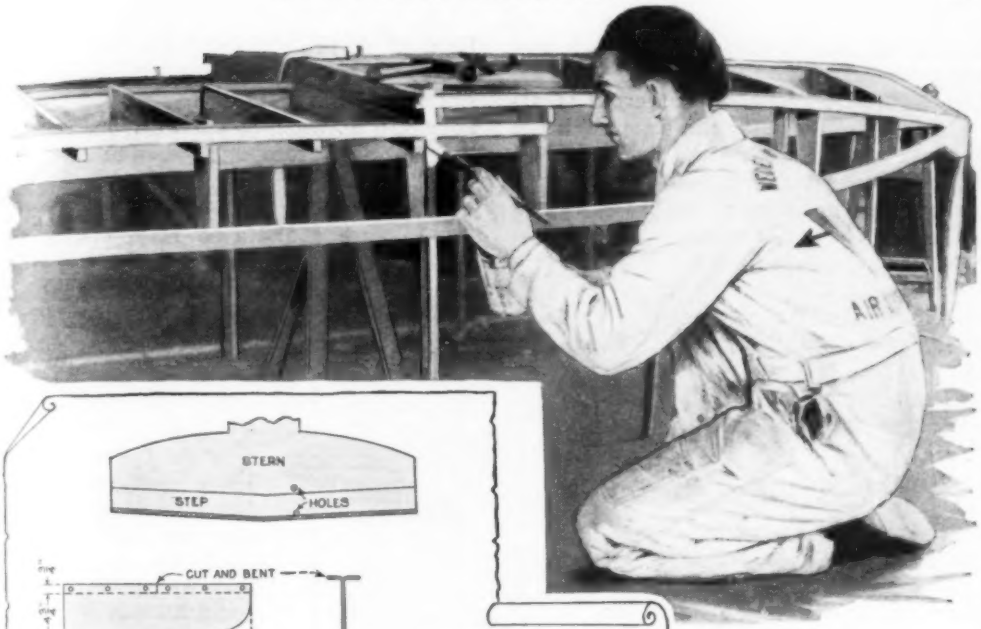


Fig. 18

Fig. 19

Fig. 20

Cut limber holes in each forward frame as was done aft, then clamp a 5/16 by 8-in. board with one edge centering on the keel, as shown in Fig. 17. Bend the board down forward over the bow and clamp, then mark it with a pencil along the edge of the keel. Unclamp and saw along this line, then plane the edge smooth and with a slight bevel, so that, when the board is



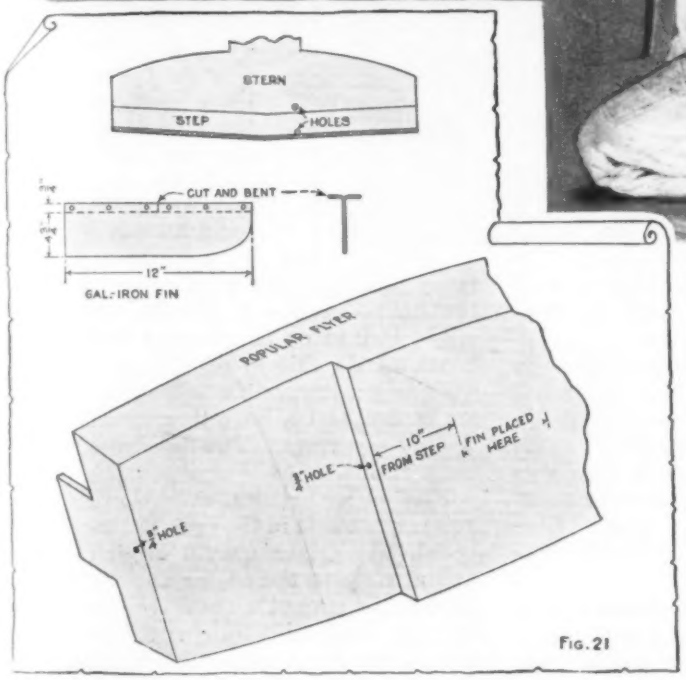


FIG. 21

in place, the edge will be vertical. Clamp in place again to check the shape of the edge. If correct, mark along the other edge on the forward chine, frames and step, so as to locate the position of the seam batten. Unclamp and sink the batten into the frames as on the after plane. Repeat the operation with the garboard strake on the other side. The shape of these planks, when cut and fitted, is as shown in the lower drawing, Fig. 17. To fasten the planks, use ⅞-in. screws, 1½ in. apart, along the chines and 2 in. apart along the keel, staggered. Screws at the step should be put in a double row, 1 in. apart. The battens are clinched with copper nails as before. It is to be remembered, just as with the side planks, that every part of the frames, chines, step and sternboard that is touched by the planks should be coated with marine glue and taped over the glued surface. The remaining boards on the forward plane are 6 in. wide, marked and fitted in the same manner.

The deck beams are as follows: four 48 in. long with a 5-in. crest; one 46 in. long with a 4¾-in. crest; one 39¼ in. long with a 2½-in. crest, and one 28¼ in. long with a 2½-in. crest. These beams are marked for curvature by driving a small nail at each end of a straight line on the board to be used for deck beams. Drive a third nail at the center above the line, the distance depending on the amount of crest desired. Then bend a batten around these three nails, which will give the proper curvature for the beam. All beams are 2 in. wide.

Remove all wedges and props and turn the boat over. Trim off the sides along the deck-line batten with a plane and saw off the block at the stem along the line that will conform to the curvature of the deck. Fasten two 48-in. deck beams with

5-in. crests at the step and No. 4 frame, using at least two screws at each end. The beam with the 4¾-in. crest is attached to No. 3 frame; the beam with the 3¼-in. crest at No. 2 frame, and the beam with the 2½-in. crest at No. 1 frame. To make the cockpit, fasten a 1½-in. square strip to No. 5 frame beam, 12 in. from the side, letting the strip extend to the stern, parallel to the side. Make two small knees and fasten them to the strips and sternboard as shown in Fig. 19. Join the strip to the side with short lengths cut from the remaining two frames having 5-in. crests. Notch these pieces over the strip, and provide vertical uprights extending from each frame, using at least three screws at each end. Sink the deck battens flush into the beams.

Now stretch a piece of common cotton sheeting over the entire deck, tacking it along the edges of the sides and sternboard. Tack it to the edges of the cockpit, then cut out the portion of the sheeting covering the opening, so that the cockpit coaming may be put in place. Give this sheeting at least two coats of clear nitrate airplane-wing dope.

From two ¼ by 6-in. boards, 6 ft. long, cut the coaming to fit in the cockpit, as shown in Fig. 20. The after end of each board is left full width, and fits against the sternboard, as indicated by the dotted lines in Fig. 19. Each board is tapered down to 3 in. in width at the forward end and is fastened in place so that it projects ½-in. above the 1½-in. strip at the forward end of the cockpit. To cover the raw end of the deck sheeting where it is tacked to the forward end of the cockpit, a small panel is fitted as indicated in Fig. 20. The panel is of ¼-in. material, 3 in. wide, cut with the top edge on the same curvature as that of beam No. 5 and projecting ½ in. above the latter.

Place a strip of ⅝-in. half-round molding along the edges and sternboard to cover the unfinished tacked edges of the sheeting. Quarter-round molding should be used on the sides and forward end of the cockpit, over the joint between coaming and deck. Make four ¼-in. floorboards, 6 in. wide, to extend from step to stern, and fasten them down ½ in. apart.

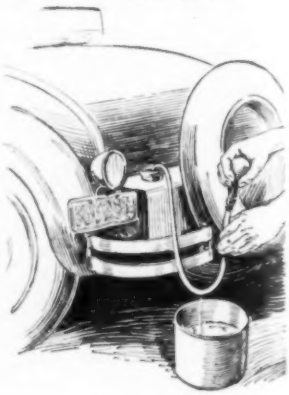
From ⅜-in. round iron, make two staybolts, 6 ft. long, to extend from the step to the stern, and install them as shown in Fig. 16.

Fig. 21 shows a simple way to keep your flyer dry. Merely bore ¾-in. holes in step and stern, as shown. Fit corks in these holes, and, while the boat is at rest or moving slowly, leave the corks in place. As soon as the boat starts to plane, however, draw out the corks and leave them out until ready to stop. The rush of water under the boat draws out all the water that might leak in or be splashed in by other boats. I do this to all the hulls I race with, as it is impossible to keep these boats really dry, and a boat that carries water doesn't win races. The fin may either be made or purchased.

This boat handles exceptionally well and is quite safe in the sea. For maximum speed, the driver should crouch in the hull as close to the engine as possible. In turning, he should move up in the cockpit and lean in the direction of the turn. All this, of course, comes with practice, but these two tips will help.

Easy Method of Starting Siphon

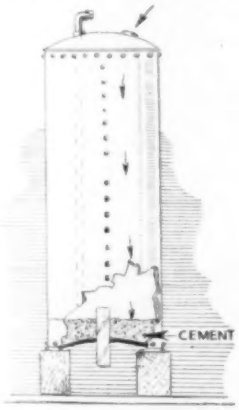
In cases where gasoline and other distasteful liquids have to be siphoned, try the method shown in the illustration. Get a length of rubber tubing with a bulb at one end and cut a hole in



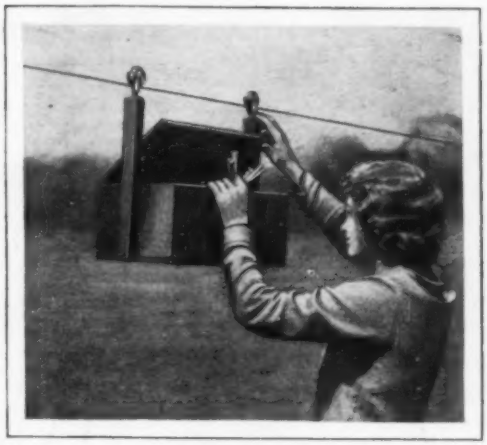
one side of the tubing about halfway between the ends. To start the siphon place one finger over this hole, and squeeze all the air out of the bulb after the open end of the tube has been submerged in the liquid. The suction when the bulb is released will draw the liquid through the tube some distance, and the finger is then removed so that the liquid can run out.

Repair for Rusted Hot-Water Tank

Cement was effectively used to repair the bottom of a hot-water tank which had rusted through. After disconnecting the tank from the water system and unscrewing the hot-water elbow from the top, the tank was placed on two 4 by 8-in. blocks, as illustrated, care being taken to get the tank plumb. The drain hole at the bottom was plugged with a roll of cardboard, 6 in. long, well greased on the outside to facilitate its removal, and extending up into the tank about 3 in. A mixture of clean, sharp sand and cement in equal parts, and enough water to make it semi-fluid, was poured through the hot-water outlet at the top with the aid of an improvised cardboard funnel. Enough cement was used to cover the bottom of the tank about 2½ in. After the cement had set for two hours, the cardboard plug was withdrawn far enough to allow the surplus water on top to drain out. Some of the cement also was allowed to run off, in order to give the top a funnel-like shape, draining toward the hole. After seven hours, the cardboard plug was entirely removed. The cement should be allowed to set for 48 to 72 hours before the tank is put back in use.—Chas. S. Edwards, Prineville, Ore.



¶Washing window sills with a weak solution of chloride of lime will be found effective in keeping midges, gnats and other insects out of the house.



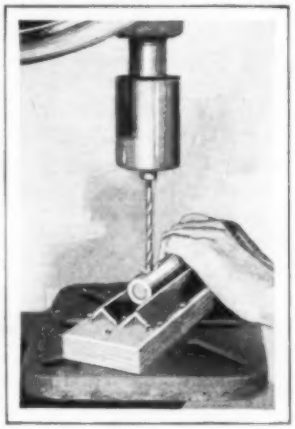
Clothespins Are Always Handy In This Box That Travels on the Line

Clothespin Box Travels on the Line

For holding clothespins where they are always accessible, get an ordinary wooden box of suitable size and nail two uprights to the ends. Fit a pulley to the top of each and slip the pulleys over the clothesline as shown in the photo. When hanging clothes, the box is pushed ahead of the work, while the opposite procedure is followed when removing the clothes. In this way, the box is always at hand for removing or inserting clothespins.

Improvised V-Block for Drilling Rod and Tubing

When drilling rod or tubing on a drill press, difficulty is often experienced in holding the material without the aid of a V-block. Such a block can be improvised from two short pieces of 1 by 1-in. angle iron, laid side by side on a wooden base and fastened with nails driven into the block along the outside edges of the angle iron. —Walter E. Burton, Akron, Ohio.



Golf *in your*

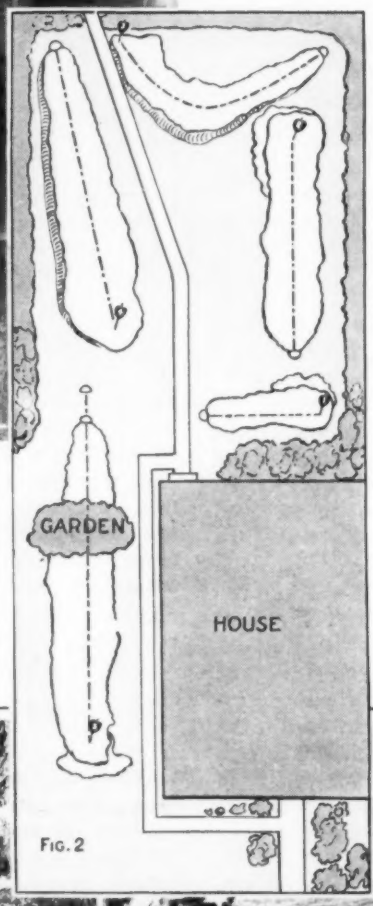


Fig. 2

Above, Mr. Evans Putting on a Back-Yard Course; Right, Plan of Course, Which May Be Varied to Suit Almost Any Back Yard by Altering Contours of Greens or Reducing Number of Holes; Below, Even the Parkway in the Street Will Serve to Better the Ardent Golfer's Game, if Practice Holes Are Laid Out as Shown

THE ideas outlined in this article are the outcome of years of experience. I really believe that I owe much of my golf success to my back and side-yard course, and to the sidewalks of Rogers Park, for, if no other ground is available, front walks and parkways can be used very nicely. I used to play down the parkways of the old street leading to the club. This is where I learned to play good golf run-up shots. I would place my ball just on one side of the walk leading to the street and then play to the next walk as close as I could. Because the walk was immediately in front of me, I would have to get

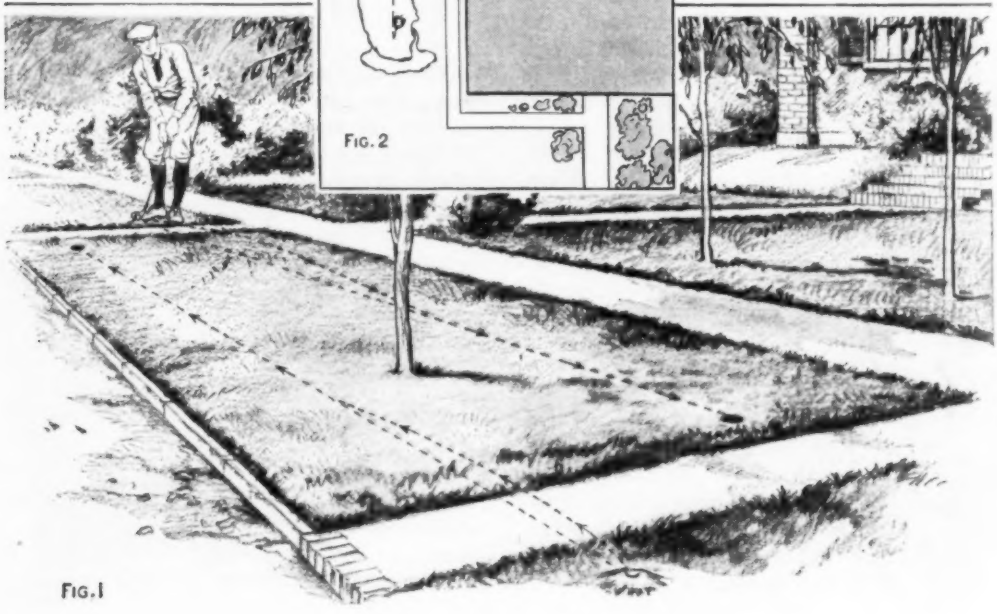
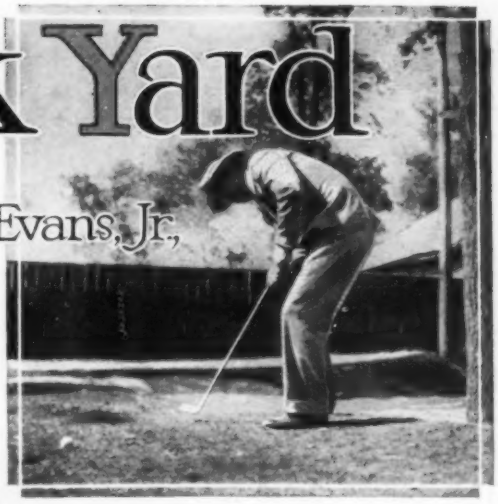


Fig. 1

own Back Yard

by Charles ("Chick") Evans, Jr.



the ball into the air for at least the width of the walk. This was splendid practice, for if a ball lies just off a green, a player should hit his ball so that it carries the ground immediately in front of him and to the edge of the green, and then it should run to the hole. So, for those who only have parkways in front of them, the arrangement in Fig. 1 will make a good little course.

This, of course, would be a two-hole course with no construction costs except the digging of holes. Because you are near enough to see the holes, flags will not be necessary. Players should keep the ground and grass trued up and in such condition that a ball will hit it and run over it in a fair way. Variety can be obtained by placing your ball nearer or farther away from the street, main sidewalk or front sidewalk. For putting practice, one can place the ball anywhere between the two walks, varying the distances as desired.

FIG. 3

As a caddie at Edgewater, I could not get enough golf even though the course was near my home. There had to be something else to use up my energy in my early inclination to play better golf, and to build up a very thin body. So I conceived the little course in my back yard. Of course, the one I am presenting here is different from my course because, since that was laid out, I have had twenty-five years of golf all over the world. But the basic idea is sound. Now anyone can have one of these courses, for the number of holes and actual size of the course need not be the same as the one for which I am giving specifications. Just modify the

plan shown in Fig. 2 to fit the ground available in your own home situation. The same general plan, minus the pitch shot, can be used for roofs of apartment buildings, too.

The materials used for this back-yard course are not many. First of all you need to true up any ordinary lawn. I predict that there will be many of these Popular Mechanics' courses and with them will come beautiful lawns, and the neighborhood, in consequence, will be very much beautified.

Five cups at $1 each equals $5. In my old course I had an interesting variety of cups, such as tomato cans, flowerpots, etc., and so perhaps many of you will eliminate even this expense. The official diameter of a golf cup is supposed to be 4¼ in. Many times it looked like ¼ in. to me. I remember that one of our most famous putters practiced on holes only 2½ in. in diameter. So, size is not all important. Also there have been times when I wished that the holes were as big as bathtubs.

It is some trick to cut an even hole, and it may be that you will need a hole cutter, which usually costs about $6. The advantage of this tool is that it takes all the dirt and holds it to put elsewhere, as needed. The cups should be changed every once in a while, at the very first sign of wear. If this is not done, the edges begin to cave in and soon the holes are all right at the bottom, but at the top they are twice the original size. There is a trick in putting in a cup; if it is just put in flush with the ground, your ball will rebound from it and will not stay in the hole. The top of the cup should be at least 1 in. below ground level, so that the ball hits earth instead of metal. Trim up any long blades of grass near the hole.

I would only buy

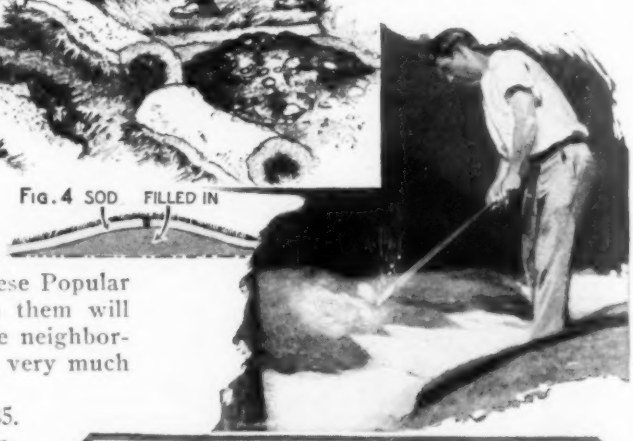


FIG. 4 SOD FILLED IN

Photo Shows Miniature Course Designed by Mr. Evans, on the Principles Outlined in This Article

one flag, and that will cost about $1, but, of course, you can probably make your own. This flag should be placed on the little green between your house and the next so that it can be seen from the road or front. Do not make it too high, or else it will lie over to one side and not look well. I would leave putting holes flagless, to avoid the trouble of taking them out and putting them in.

For 10 ft. around these holes pay special attention to the green grass. In fact, all over the little space I would true the grass and treat it. One of the best helps you can get in this operation is a small water-ballast roller which should cost about $14 to $18. The cutting of grass is an important item, also. A big course brings joy when it is cut well and so will a little one. The kind of mower you should buy or use depends on the sort of grass on your lawn. If it is creeping bent, you will probably need an eight-bladed mower; if blue grass, a five-bladed mower will do. You cannot count the cost of this, of course, as you would have a lawn mower anyway.

Frequent top dressing is really an excellent thing for the greens, and some good black soil should be obtained for this purpose. If the dirt is gummy, mix with it a little fine torpedo sand. Bear in mind that this sand is a great thing for use in truing up your course. After the top dressing is on, you will need something to distribute it evenly over the surface and for this purpose there is nothing better than a steel mat, which will cost about $4. This is not absolutely necessary, but it is worth while. Of course, you will need a few rakes, but you will need them for your gardening anyway. A good bamboo pole to flick the worm casts off in the mornings is also a good thing. The price is negligible—about 35 cents apiece. Sprinkling is vital, so you might need a little extra hose and perhaps a sprinkler.

If you are to use your course at night, you will need an electric light, so this problem should be taken up with your local electrician. They are using some non-glare lights in Chicago that are very satisfactory, but, in most cases, one light well placed will do the work nicely.

I am a firm believer in having the feet firmly on the ground when one putts; therefore, do not make any undulations

that would place one foot higher than the other in any marked way unless the player has put himself in that position. I mean that the tees and the space around the holes should by all means permit a sound stance. You can get little tee plates (10 cents apiece) and move them around every other day so that there will not be too much wear in one place.

Your equipment will consist of four or eight putters and two mashie-niblicks. (Putters at $1.50 each; mashie-niblicks $2 each.) Buy your balls from a cheap place, about 50 cents apiece. Have two dozen around. If you wish to be fancy, you can put a little irregularly edged trap where it will catch balls which might interfere with play on a near-by hole. Get some white sand for these traps, to show off the green well.

A Bunker on a Miniature Golf Course, Which Offers as Much Hazard to the Golfer as Those on the Regular Course

There are several ways to treat the boundaries of the holes, especially the putting ones. First, you can simply leave them flat and even with the rest of the lawn. Second, you can cut, with a spade or a sod cutter, at right angles to the line of play, next cut the sod back as shown in Fig. 4, roll it back and fill under it, then tamp the sod back and fill in the cut with good soil and seed it. This gives a gentle roll to the green. In the third place, you can get a terrace effect, as shown in the various photos, by cutting with a sod cutter or spade around the curving boundaries of the greens shown in Fig. 2, then removing the sod as in Fig. 3, filling in with good earth to make the terrace the height wanted, and finally tamping the sod back in place as in Fig. 5, filling in all spaces with soil, and seeding. The edges of the terrace can be filled in with good dirt and sod, and at the traps with white sand. One thing that is important is the slope of the terrace; it should not be too sharp. A ratio of about 8 to 1 will let the lawn mower ride over the edge without "scalping" it. Be sure that the slant of the green faces the line of play, and that the rolls for the running ball are never sharp slopes, but very gradual, smooth inclines.

In order to aid your regular golf game this miniature course should be refined on its top surface to give you what you would get playing on a regular course. They say that 45 per cent of the game actually takes place on the green. About 7 per cent more takes place just off it and not in traps. Therefore, if you conquer your miniature course, you will have control of your regular game. There is a man in the east who plays as good a game as any businessman in the country. He keeps his game up because he not only has a miniature course in his yard, but a bunker as well, together with two full-shot distances. I have always felt that, if I had that constantly in my vicinity, I could always play championship golf and take my pleasure in oceans of health.

Referring to Fig. 2, the contour of hole No. 1 should be as nearly flat as possible. Just a simple, straight putt to start out with. For hole No. 2 the surface should provide two gentle straight rolls before reaching the hole area. This means that a well-hit ball will roll smoothly up and down one, and then the other, in a straight way. If the player has used the right speed, he should just reach a hole-high or hole position. So, watch where you put these rolls. The top of the putting area on hole No. 3 should tip from left to right, but as always, on all rolls, they should be very gentle. The hole area should be equally gentle. This hole should teach the borrow from left to right. The angle of this tipping should be varied, so that a player will not allow the same distance to the left of the cup all the way up the hole.

The top surface on hole No. 4 here

Note, in This and the Other Illustrations, How the Greens Are Terraced, and How the Traps Are Placed on the Slopes

should tip from right to left the whole length of the hole, which is just the opposite of the preceding hole, to teach the ability to borrow from right to left. Here again the slope should not vary evenly down the hole.

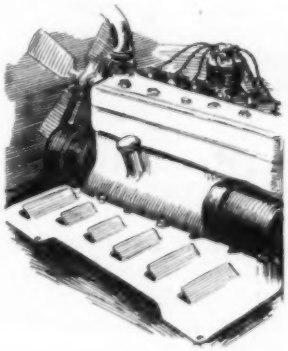
There are two tees to hole No. 5. The garden, or flowerbed, should be like a water hazard, bunker or pit of any kind. The nearer tee will teach you to pitch over it with a low trajectory and the farther one with a higher trajectory. I cannot impress it enough on the amateur hole builder to have the ground, where the ball should fall, smooth, fair and true.

Testing Silk

Silk fabrics are often "loaded" to give them the appearance and feel of heavy fabric, because silk so treated is cheaper than a piece of all-silk goods of the same weight. The loading process consists in impregnating the silk with metallic salts, such as tin and lead. A chemical action is set up in the fiber by this process which weakens the goods to some extent; furthermore, when the loading materials have been removed from the fabric by washing, the garment is in many cases practically ruined. Loading also causes the silks to crack and split at folds and creases. A simple method of detecting loaded silks is a burning test. A piece of pure silk when burned, will shrivel up like wool. If metallic salts are used, the silk ash will retain its original shape and pattern.

Dustpan Ventilator for the Auto

Even though all connections may be tight, a hot motor will usually give off some gases, which may be carried into the passenger compartment. This trouble can easily be avoided by providing ventilators on the dustpan, similar to those on the hood but deflected in opposite direction.



A RADIAL ENGINE FOR MODEL AIRPLANES

Constructed of balsa wood so that it is light enough to be used on flying scale models, the radial engine shown has proved highly satisfactory, and

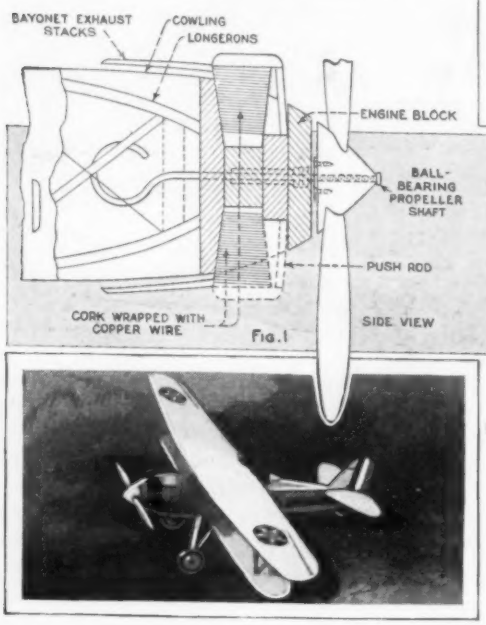


Fig. 1

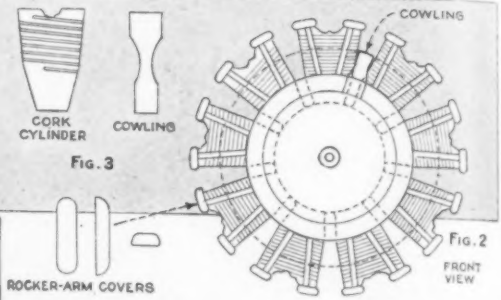


Fig. 3

Fig. 2

This Radial Engine for Model Airplanes Looks Realistic and Can Be Used on Flying Models

looks very realistic. The shape of the engine block makes it easy to cowl and simple to mount on any type of fuselage. Fig. 1 shows a side view and the method of mounting the engine. The shaded section is the engine block, which can be turned out on a small bench lathe. The dimensions of the block are not shown, as they have to be varied to suit the size of the plane. In turning the block, the small groove in the center is made just wide enough so that the small end of the cork cylinder fits snugly into it. The front is turned to the shape of the spinner on the propeller, or it may be rounded off just a little more than is shown and painted to resemble the shutters used on the late types of radial engines. A hole is drilled through the center to receive the propeller shaft. In this case a ball-bearing shaft was used. Fig. 2 shows the front of the engine with the nine cylinders spaced at equal distances, and the position of the rocker-arm caps and push rods. Fig. 3 shows the cork cylinder. The bottom of each cylinder is tapered to provide clearance as shown. The top of the cylinder is grooved to resemble the cooling fins of the cylinder head. The fins on the side of the cylinder are made of copper wire. By punching a hole in the cork near the top you can insert one end of the wire to hold it in place, after which it is wrapped around the cork seven or eight times, the turns being spaced about 1/32 in. apart. The other end of the wire is bent at a sharp angle and pushed into the cork, where it will be held securely. The rocker-arm caps are made of balsa and are ambroided to the cylinder heads. The push rods are made so that they fit firmly between the rocker-arm caps and their base on the engine block. Match sticks, sandpapered smooth, are suitable for this purpose. Cowling around the cylinders consists of strips of aluminum cut to the shape shown. These are slipped under the fuselage cowling, which is in turn fastened to the large round part at the back of the motor block, while the front end is bent down and slipped in against the flat surface just ahead of the rocker arms. The exhaust stacks are of the bayonet type, made of match sticks pointed at both ends. One end is forced into the cork under the rocker-arm cap at the point where the exhaust valve is

supposed to be, ambroid being used to keep it in place. If desired, an engine of this type can be made with five or seven cylinders. The photos show a model of the Curtiss "Sea Hawk" equipped with such a radial engine.—L. J. Mandelko, Long Pine, Nebr.

Coloring Copper Brown and Black

Different shades on copper, ranging from a light brown to a deep black, may be obtained by using a weak solution of liver of sulphur (sulphuret of potassium). A half ounce of the chemical to a gallon of water suffices to make a solution strong enough for brown colors. By increasing the quantity, using the same amount of water and bringing it to the boiling point, the same colors can be produced on brass. To obtain the popular verde-antique finish, the work is stippled with a solution made from 4 oz. copper nitrate, 4 oz. calcium chloride and 1 oz. bichromate of soda in 1 gal. of water. After coating the work with this solution, the high lights are rubbed down with a cloth and finely powdered pumicestone, after which lacquer or wax is applied as desired.

Handy Cutter on End of Nail File

By grinding a small notch in a nail file and honing it to a razor edge, a handy nail cutter can be provided. The advantage of the grooved edge over the straight knife blade, is that you are not so apt to cut the nail and spoil its shape. Besides, the file and knife are always together.—Albert J. Monfils, Worcester, Mass.

Removing Grass Stains from Clothing

The removal of grass stains from clothing is not the easiest task. Washing a garment stained in this way will not do. A method that is effective, is to use a small amount of ether, which can readily be obtained in any drug store. Saturate a small cloth wad and rub it over the stain.

Fancy Wrought-Iron Brackets Holding a Board Make an Attractive Window Shelf

Window Shelf for Potted Plants

Window shelves of the kind shown in the photo improve the appearance of the house. Two or three fancy iron or wooden brackets are first attached to the wall, and a suitable piece of 2 by 10-in. stock, well painted, is fastened over them. In this particular instance, wrought-iron brackets were used, which offset nicely against a stucco background. If the board is left loose, it can be removed during the winter to prevent an accumulation of snow.—C. A. Byers, Los Angeles, Calif.

Dividers Hold Down Tracing Cloth When Lettering

When lettering with ink on a tracing, the cloth has a tendency to rise away from the board, which is rather annoying and makes lettering somewhat difficult. Holding the cloth down with the fingers often results in blotches, and it is much better to use a pair of dividers for the purpose, as shown. The dividers are held in the left hand while the lettering is done with the right.—H. L. Wheeler, Springfield, Vt.

RIGGING A

by C. Ed. Packer

The Author with Trophies Won in Paddling and Sailing Canoe Fitted with the Rig Described

CANOE sailing has passed through many stages. Some of the earlier types resembled small schooners, others carried two sails—and a combination sailor and acrobat. But from all the various types tried, one stands out as the most practicable for all purposes. It is designated by the American Canoe association as the cruising type, and comprises an open canoe with single sail, leeboards and a paddle for steering.

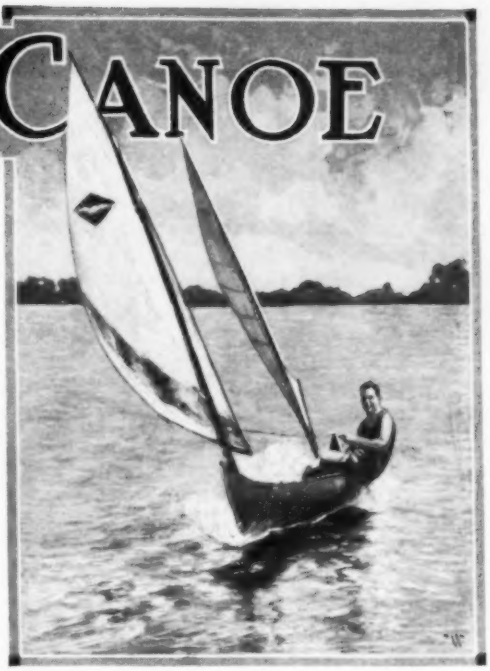
The advantages of this rig include economy, ease of handling, safety, ease of stowing or transportation and ability to show surprising speed, if properly rigged. But there is the catch. It is the purpose of this article to explain how to rig such a canoe for maximum speed and general utility.

It really makes no difference where we begin on the work of making the sailing rig, so let us first consider the sail itself. The "ladybug" model sail is an excellent type, which has been in use for over 25 years. The cloth used for making the sail should be a very fine unbleached cotton duck, commonly called "zephyr" sailcloth or "balloon silk." This cloth comes about 40 in. wide. Sew four widths together with an overlapped double seam. Then lay this large piece down on the floor and smooth it out. Referring to the sail plan, place a fine nail in the corner marked "tack." Now just smooth, but do not pull, the cloth so that you can mark off the corners "peak" and "clew" according to the dimensions given in the diagram. Very lightly nail these corners into place. Between these three nails, stretch a string to mark accurately the edges of the sail.

Mr. Packer Winning the Canoe-Sailing Race in the First Annual Aquatic Meet of the American Legion; the Rig Is Identical with the One Described in This Article

If your boat is very round on the bottom, you will want very little draft (see sail plan). On the other hand, if your boat is very flat on the bottom, you will get best results by cutting your sail with considerable draft, about 1½ in. extra material being allowed where the diagram is marked "draft." Along

SAILING CANOE



the leach of the sail, measure out 3 in. and mark your cloth with an easy curve from the peak to the clew. With a piece of soft charcoal mark out the whole sail, allowing 1 in. outside of the dimensions given for hemming. In hemming, be very careful not to pull or force the cloth in the machine, or the edge will either pucker or draw. When the sail is hemmed, sew on a double thickness of canvas tape along the head and foot, to prevent stretching. Three batten pockets, 1 in. wide and 12 in. deep, should be sewed on at right angles to the leach, so as to divide the length into four equal parts. Light spruce battens—thin boards—are later sewed into these pockets to hold out the leach.

While grommets may be put in the tape along the head and foot of the sail, a better and easier way is to sew on ¼-in. galvanized rings at 6-in. intervals, for fastening the sail to the spars.

With the sail complete, it is well to make it mildew-resistant. Dissolve ¼ lb. each of sugar of lead and powdered alum in a large pan of water. Let the sail soak in this overnight. Then, without wringing it, hang it in the shade to dry.

For the spars, nothing but clear, straight-grained spruce should be used. While tape was placed on the sail to prevent stretching, it is best to play safe and make both spars 6 in. longer than the head and foot of the sail. It is far easier to cut spars down the second season than it is to "stretch" them. It is money well spent to have the spars ripped square to about 1⅝ in. From there they can be worked down with drawshave and plane to a diameter of 1½ in. in the center, tapering uniformly to 1 in. at the ends.

The spars, when properly shaped, can be hinged together as shown in detail A on page 504. The material required

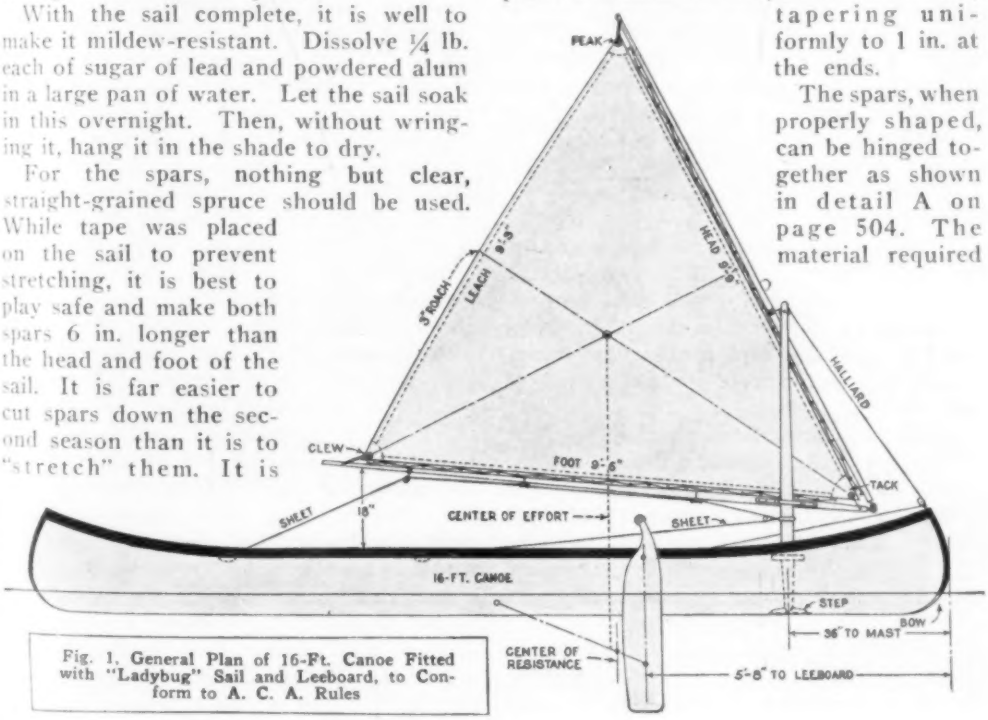


Fig. 1. General Plan of 16-Ft. Canoe Fitted with "Ladybug" Sail and Leeboard, to Conform to A. C. A. Rules

consists of two ⅛-in. eyebolts, 2 in. long. The boom jaw is made of ⅜-in. half-round brass. A rivet should be placed in the outer part of the jaw to prevent spreading. The jaw is attached to the boom with brass screws. It should be placed so that the distance from end of yard to center of mast is 18 in., as shown. Finish the spars with two or three coats of spar varnish.

Now lay the sail out flat on the floor and put the spars in place. Midway between the rings on the head and foot of the sail, place a mark on the spar. While doing this, see to it that the sail is drawn out smooth but not actually tight. At each mark on the spar, drive a small brass screweye. At the end of each spar, place a larger screweye. Now thread a stiff brass wire through eyes and rings, to secure the sail to the spars.

The mast (Fig. 3) should be 5 ft. 6 in. long, finished to a diameter of 2 in., 2 ft. up from the bottom. Taper it off to 1½ in. at the top. For hoisting, it is well to mount a sheave near the top. This can be obtained by driving the pin out of any galvanized pulley to get the wheel. Then slot the mast for the sheave, and mount it on a bolt run right through the mast. The bottom should be tapered steeply to a 1-in. square.

To mount the mast in the boat make up the steps shown in Fig. 3. These should be of any tough hard wood. The bottom step should be about 6 in. long, 2 in. wide and 1 in. thick. Shape it about as shown and square out a hole in the center to take the mast.

While it is sometimes possible to "get by" by merely boring out a thwart that is already in the canoe, it is frequently necessary to make a new step thwart as shown. There are two reasons for this. One is that the original thwart may not be wide enough to have sufficient strength after the hole is bored. The other is that the thwart may not be in the right place. Location is important and will be considered in detail later. Design your new thwart step along the lines of the thwarts already in your canoe, but be sure to make it 4 in. wide, so as to have 1 in. of material fore and aft of the hole.

The sail equipment is now ready to be placed on the boat, but it is absolutely necessary to finish the leeboard next. The reason for this is that the point of lateral resistance must be known before the sail can be placed. One leeboard is all that is needed. In fact, for best results only one board is ever used in racing. The board may be made of almost any straight-grained wood, but spruce or mahogany are recommended.

Cut the leeboard, from 1-in. clear wood, to the shape shown in Fig. 3. Then, with a marking gauge, go around the edge of the board, marking the center of the edge carefully. With this as a guide, you can begin to taper the board to obtain lightness and reduction of resistance. Do not make the entering edge sharp, but merely round it carefully, bringing it down in width slightly like a paddle. From 2 in. back of the entering edge, the board should taper uniformly to the trailing edge. This requires lots of careful planing, but is necessary for maximum speed.

The board is carried on a crosspiece, details of which are shown in Fig. 3. The crosspiece should be 1 in. wider than the width of your canoe, as measured 68 in. from the bow. A thwart is installed so you can bolt the leeboard crosspiece in the same place each time you rig.

A brass carriage bolt or an iron one may be used. When putting it in place, see to it that the leeboard crosspiece is carefully whittled out to receive the bolt. Then, just as carefully, whittle out the end block that is to be bolted down over the large bolt. When done, the large bolt should be very firmly gripped in wood. If an iron bolt is used, dip it in spar varnish before bolting the two pieces of wood together. Then, by keeping the threads oiled, pretty fair results will be obtained. The leeboard and crosspiece should be finished with two coats of spar

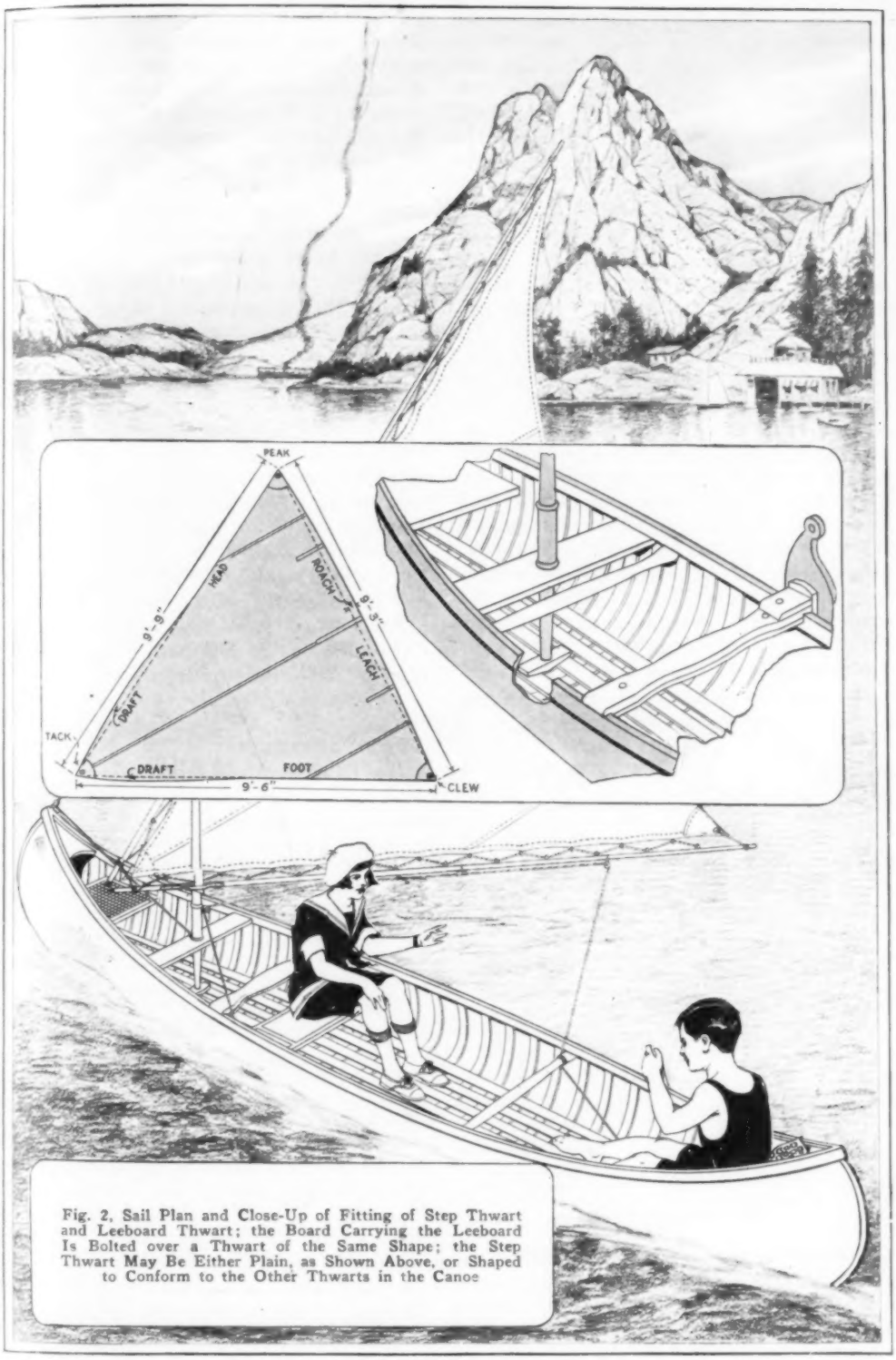


Fig. 2, Sail Plan and Close-Up of Fitting of Step Thwart and Leeboard Thwart; the Board Carrying the Leeboard Is Bolted over a Thwart of the Same Shape; the Step Thwart May Be Either Plain, as Shown Above, or Shaped to Conform to the Other Thwarts in the Canoe

varnish and the board carefully sanded and oil-rubbed for absolute smoothness.

With the leeboard installed, place the canoe in the water. Wade in with it and grasp one gunwale with one hand. Pull sideways on the boat. The combined resistance of the leeboard and keel will prevent much movement. If, when you pull the boat sideways, one end or the other tends to swing up, move your hand toward the end of the boat that does not swing up. In this way you will find a point where the canoe may be dragged straight sideways. This point is the center of lateral resistance. Mark it on the gunwale.

Lay the sail flat on the floor. Then tie a string at the tack and stretch this string out to the center of the leach, and stretch a string from the clew to the center of the head of the sail. Where these two strings cross is the center of effort. It would be well to put an ink speck on the sail at this point. With the sail hoisted, a line dropped vertically from this point should be aft (back) of the center of lateral resistance of the canoe. This is important for safety and convenience in handling.

boat that naturally heads into the wind, a paddle over the leeside (away from the wind) has complete control. Pulling in on the paddle handle makes the boat swing away from the wind, while letting the paddle trail permits the boat to head up into the wind.

The bottom step should be put in place with four brass No. 10 2-in. screws run into the keel. These should be soaped and the holes drilled to prevent breaking the screws or splitting the wood.

With the canoe leveled, using a carpenters' level from side to side and on the keel, the thwart step should be located. This is done by slipping this part in place over the mast which is standing in its step. Then two helpers should sight to see that the mast is vertical. One should sight to see that the mast is true from side to side, while the other sees that it does not slope fore or aft. When it is vertical, mark the exact location for the thwart on the gunwales, remove the mast and fit the thwart into place.

Put the mast back in place. Lay the sail down in the canoe with the throat around the mast. Now raise the gaff

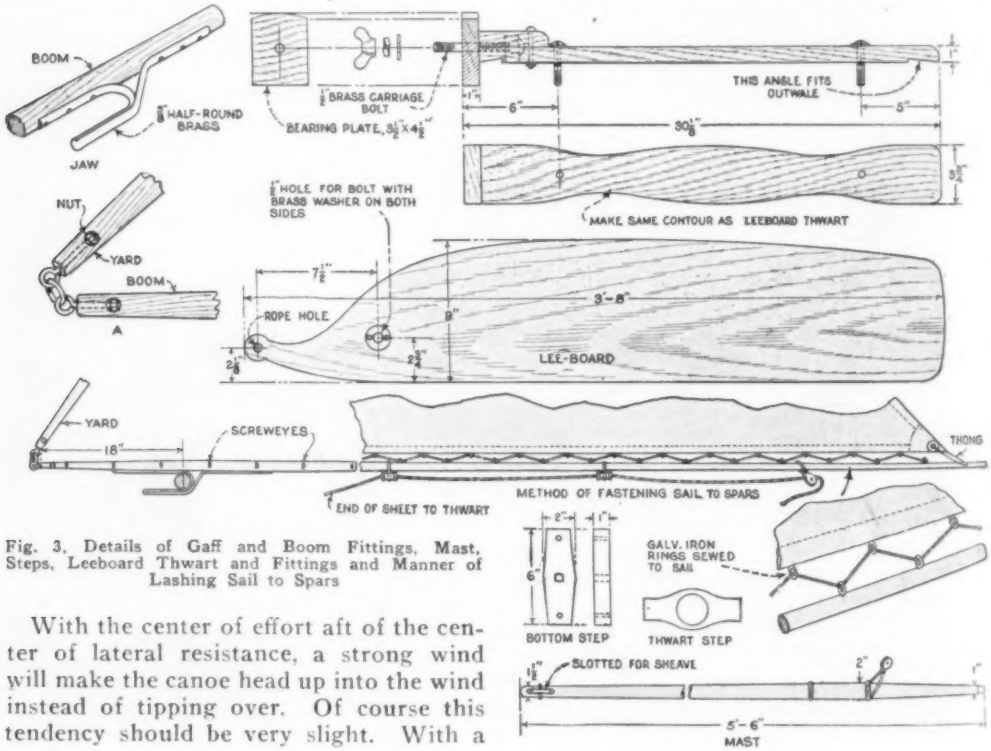


Fig. 3, Details of Gaff and Boom Fittings, Mast, Steps, Leeboard Thwart and Fittings and Manner of Lashing Sail to Spars

With the center of effort aft of the center of lateral resistance, a strong wind will make the canoe head up into the wind instead of tipping over. Of course this tendency should be very slight. With a

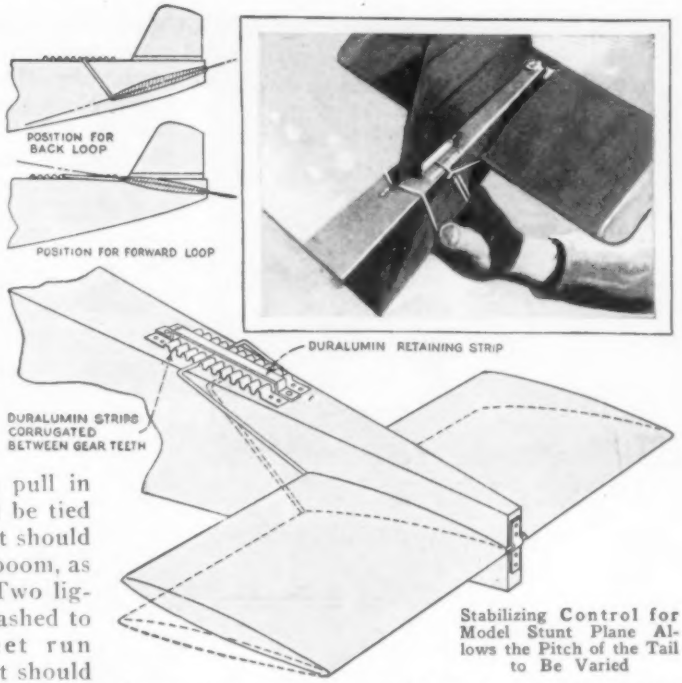
(spar attached to head of sail) until the tack clears the deck or gunwales of the canoe by 3 or 4 in. Note where the gaff touches the sheave in the mast when so raised. At this point, tie the halliard. The halliard should be threaded through the mast sheave and down through a pulley fastened in the bow, as shown in Fig. 1. The halliard should then be run aft to a cleat placed near the center of the boat.

The sheet (line used to pull in or let out the sail) should be tied at the thwart farthest aft. It should lead up to a pulley on the boom, as shown in Figs. 1 and 3. Two lignum-vitæ eyes should be lashed to the boom and the sheet run through these. At the mast should be another pulley through which the sheet passes as it is led back to the sailor. This manner of handling the sail relieves the strain on the arms of the sailor to a great extent and prevents the sail from blowing up when struck by a sudden puff of wind.

The only thing remaining to do is to get used to handling the boat. In trying it out, if it heads up into the wind too much, the leeboard must be moved back a little. If it falls off from the wind, the leeboard should be moved forward a little. Every time the leeboard is put on or moved, it should be checked to be sure it is absolutely parallel to the keel.

Stabilizer Control for Model Stunt Planes

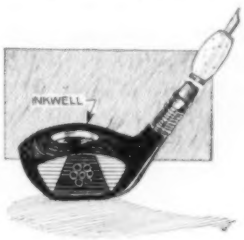
An effective stabilizer control for model stunt planes, which was devised by a California industrial-arts instructor, is shown in the illustrations. A duralumin spar is pivoted at the tail of the fuselage and a swinging double arm of wire is provided to raise and lower the leading edge. This arm is held in place by means of a pair of corrugated duralumin strips on each side of a flat retaining strip of the same material. The latter holds the wire arm in the desired notch. The corrugations are formed by running the duralumin strips between a pair of loosely set spur gears. By means of this simple device, in combination with a rudder having a right-and-left adjustment, the model plane can be made to do a variety of stunts.


POSITION FOR BACK LOOP
POSITION FOR FORWARD LOOP
DURALUMIN RETAINING STRIP
DURALUMIN STRIPS CORRUGATED BETWEEN GEAR TEETH

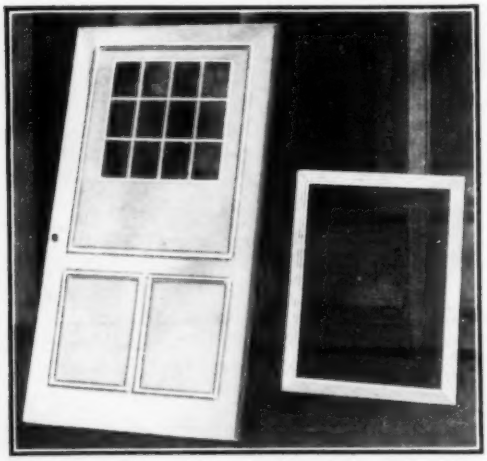
Stabilizing Control for Model Stunt Plane Allows the Pitch of the Tail to Be Varied

Old Golf Club Makes Novelty Inkwell and Pen Holder

By drilling a hole of the proper size in the head of an old driver to accommodate a small bottle, a novel inkwell can be made. If the bottle does not fit as tight as desired, it can be sealed with wax or putty. The end of the broken shank may be cut off flush and drilled to receive a pen. Such an inkwell will not overturn easily and will also serve as a paper weight, besides preserving a favorite driver that is no longer serviceable on the links.—Henry S. Rorer, Norfolk, Virginia.



¶When applying more than one coat of shellac to patterns, sandpaper each coat, when dry, before applying the next.



Any Screen Door Can Be Converted into a Combination Screen and Storm Door

Combination Screen and Storm Door

Almost any screen door can be converted into a combination screen and storm door. The screen is first removed from the lower section of the door and plywood panels are substituted. Then the screen is similarly removed from the upper section and a suitable sash is trimmed down to fit in the door frame as shown in the photo. Molding is used on the outside and small turnbuttons on the inside, to keep the sash in place, although other fasteners may be used if desired. A separate screen, the same size as the sash, is then made so that it is interchangeable with the latter.—H. Rossiter Snyder, Guilford, Conn.

"Oxidizing" Copper and Brass

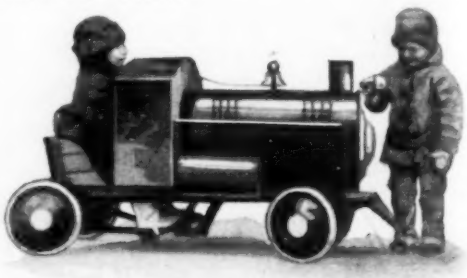
The antique finish so much admired in fixtures, hinges, trays, etc., known also as "oxidized" work, is produced on both copper and brass in exactly the same way. The process is cheap and simple. A strong solution of potash and lye, using about two tablespoons to 1 qt. of water, is first made. A second solution, consisting of about 2 oz. of sulphide of potash and 2 qt. of water, is then prepared. After fastening a short piece of wire to the article, to serve as a handle, the article is dipped into the first solution to remove all grease and dirt. It is then rinsed in hot water and dipped into the sulphide solution until it has a good sharp-black color in the case of copper, and a grayish black in case of brass. The article is again rinsed in hot water and hung up to dry. When thoroughly dry, it is buffed all over lightly on a soft-cloth buffing wheel, then buffed so that the copper will show through in spots to produce the desired effect. A little practice will enable one to buff a piece so that it will look as well as if the work had been done by an expert.

Filling the Auto Vacuum Tank

If a funnel and small gasoline can are at hand, the simplest way to fill the automobile vacuum tank is to remove the plug at the top of the tank and pour in the gasoline. If no funnel is available, the tank can be filled quickly as follows: Close the throttle, shut off the ignition and press the starter switch; the action of the motor will then cause enough suction to draw the gasoline from the rear tank into the vacuum tank. The throttle must be kept closed, as otherwise the engine draws most of the air through the carburetor.

Child's Toy Locomotive Made from Oil Drum

Using the chassis of a child's toy automobile, a miniature locomotive can be built from an oil drum, which serves the purpose of a boiler, and a length of stovepipe, which is used as a stack. Additional features are a cab, which is made of tin, and a cowcatcher. The engineer has a seat in the rear and supplies the power with his feet. Painted suitably, this makes a very attractive outfit.

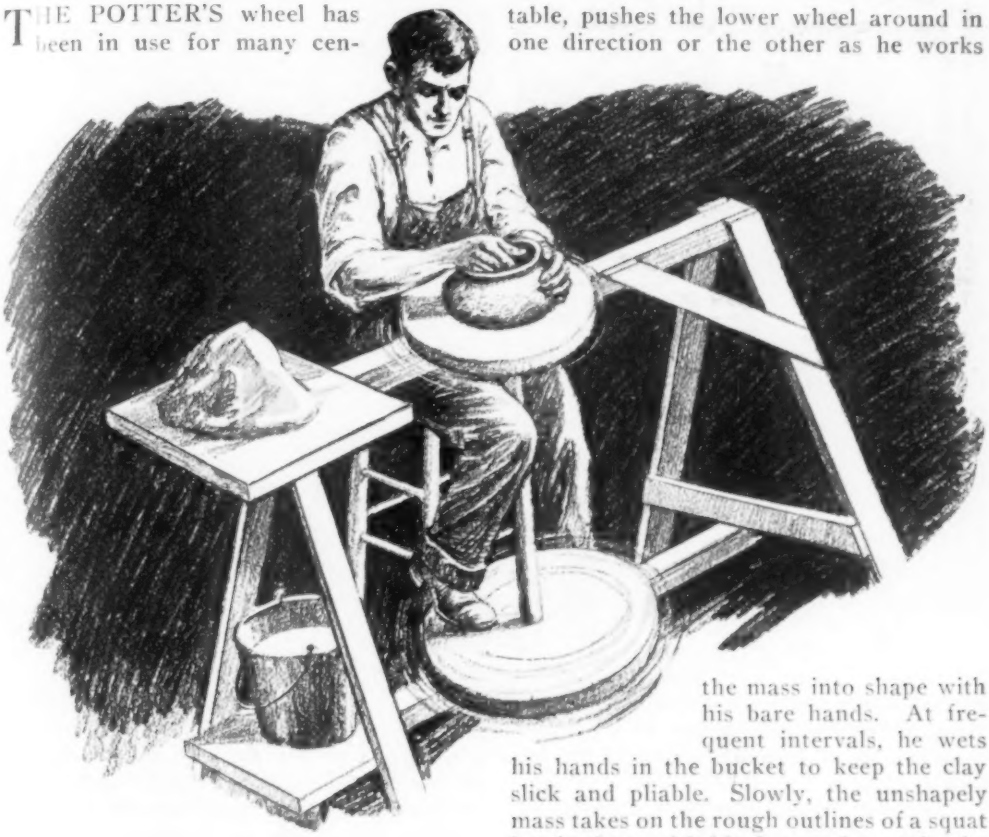


Child's Locomotive Made from Oil Drum Mounted on Toy Auto Chassis

¶For all diameters the transverse pressure on a boiler is double the longitudinal pressure.

SIMPLE POTTER'S WHEEL MAKES ARTISTIC JARS

THE POTTER'S wheel has been in use for many centuries and still retains its fascination. With a little practice, one can make very attractive ornamental jars, vases and other forms of simple pottery.



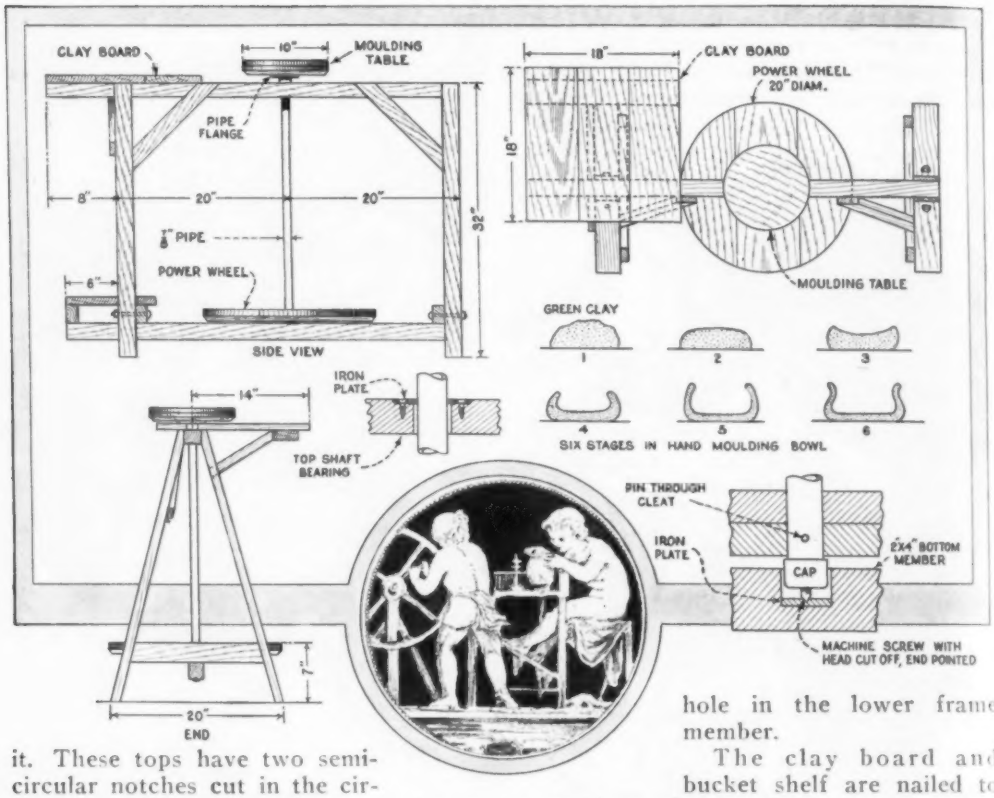
Making the potter's wheel itself is merely a job of simple carpentry. Herein is illustrated one used in demonstrations at an old Spanish exhibition in Pasadena, Calif. The original had obviously been in use for generations, and in the drawings some improvements have been added, especially in the shaft bearings.

Note that there are no pulleys, belts, gears or levers, simply an upright shaft, with a large wooden wheel at the bottom, which is spun with the foot, and a turning table at the top supported by a sawhorse framework. The raw-clay board at one end and shelf for water bucket beneath add to its convenience.

In turning a bowl, the potter places a large lump of moist clay on the molding table, pushes the lower wheel around in one direction or the other as he works the mass into shape with his bare hands. At frequent intervals, he wets his hands in the bucket to keep the clay slick and pliable. Slowly, the unshapely mass takes on the rough outlines of a squat bowl; then, with his fingers, he works the sides thinner and higher. Sometimes a thin board, cut in the profile of the inside of the bowl, is used to remove superfluous clay. In the later stages less water is used; the vase becomes more set, that is, the clay is stiffer. When completed, a fine wire is pulled under to loosen it from the wood, and the bowl is lifted off together with the removable board.

Two-by-fours are used throughout for the frame, with ¾-in. boards for raw-clay and bucket shelves and for corner braces. The 10-in. molding or turning table is also made of ¾-in. material, having a broad cleat at the bottom, to which a pipe flange is screwed and the ⅞-in. (outside diameter) pipe shaft in turn screwed into the flange.

A removable, circular top is provided—several of them, in fact, when a number of jobs are to be turned out—so that the work can be lifted off without damaging



it. These tops have two semicircular notches cut in the circumference, to fit over dowels in the rotating table.

Use 1½-in. boards for the power wheel, as the extra weight serves as a flywheel to keep the device rotating between "kicks." Rubber-soled shoes, of course, give the best traction. Three cleats or battens are nailed under the power wheel, the central one of 1½-in. stuff and secured to the shaft with a long pin.

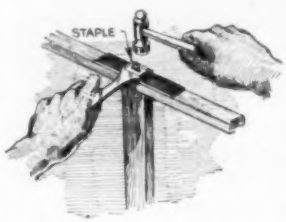
For the upper shaft bearing you can simply bore a hole through the two-by-four, about 1/16 in. larger than the diameter of the shaft, to allow for swelling of the wood. A better bearing, however, is an iron plate bored for the shaft and screwed to the top frame member. At the bottom, the capped pipe can simply be set in a hole bored in the lower two-by-four, but friction will be vastly reduced by making an end bearing as shown in the drawing. This consists of a ¼-in. machine-screw driven into the pipe cap, the head being sawed off and the end pointed. This revolves in a countersink made in a steel plate or disk at the bottom of the hole in the lower frame member.

The clay board and bucket shelf are nailed to extensions of the main frame. To make a first-class job, join the principal frame members together with carriage bolts.

With this simple equipment and a quantity of ordinary clay from brickyard for pottery, you will enjoy constructive entertainment and should be able to produce some very artistic pieces, such as garden-wall jars, flower bowls and vases.

This Staple Holder Saves Your Fingers

Held in a metal handle, a slotted piece of heavy rubber has been found handy as a staple holder, preventing frequent injury to the fingers. The slot should be cut to suit the size of staples used, so that they will fit snugly. They are driven until the head comes flush with the rubber, after which the holder can be removed.



Copying Newspaper Halftones

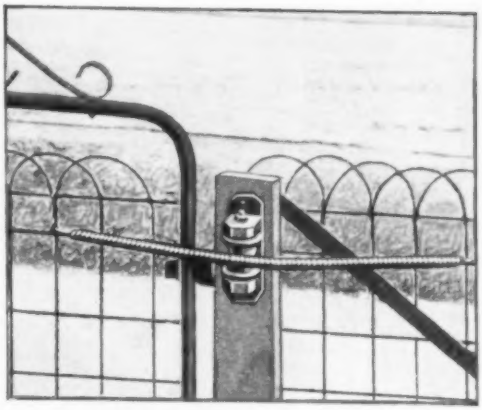
Many good photographers fail to get successful results when trying to copy pictures in newspapers or magazines. Success is assured if the directions given below are closely followed. Place a piece of ground glass in a printing frame, ground side up. On this lay a thin piece of clear celluloid and put the picture, face down, upon it. Fasten the back of the frame, and stand it on a table squarely in front of the camera. Illuminate the picture from the front, to avoid reflections, but do not let the light shine into the lens. Use a "process" plate, not the ordinary kind; this is slower in action, hence an exposure of about double the usual time must be made. Focus carefully and do not shake the camera during exposure. The ground glass will eliminate the grain of the halftone and paper entirely. If the halftone screen is a very coarse one, it will be found better to reverse the glass, thus placing the ground side farther away from the face of the picture.

Crib "Gym" for the Baby

Two small bamboo poles, a trifle longer than the baby crib, lashed on firmly, help to prevent the baby from falling out and also provide plenty of exercise when he

Two Bamboo Poles Lashed to the Crib Prevent Baby from Falling Out

pulls himself up on them. Bamboo is used for this purpose as it does not sliver and can be easily painted if desired. The poles should be attached about 6 in. from the side rails to be most effective in preventing the child from climbing out.—Geo. Pommer, Jr., Minneapolis, Minn.



Effective Method of Attaching Coil Spring to Gate to Obtain Necessary Leverage

Coil Spring Keeps Gate Closed

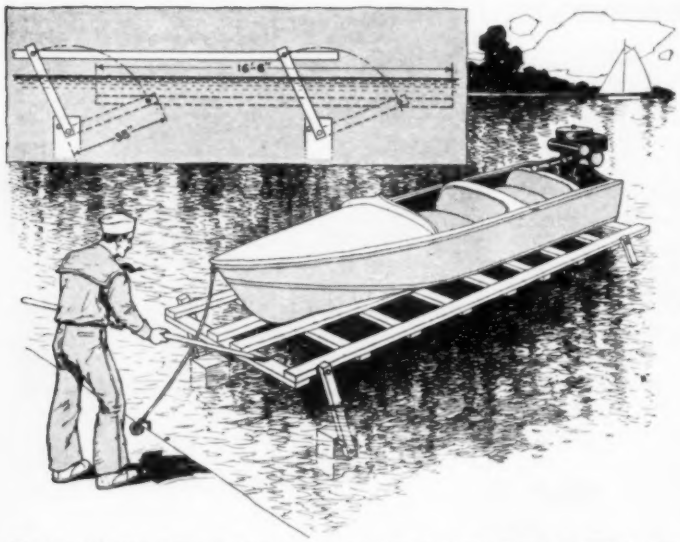
A variation of the usual method of attaching a coil spring to a door, is illustrated herewith. In this case it was rather difficult to fasten the spring as there was no point to which its dead end could be attached to exert an angular pull. A small hardwood spool was mounted so as to project a short distance from the fence, and the spring was passed over it as indicated. As the gate is opened, the spring stretches but passes smoothly over the revolving spool, losing none of its tension or pull. One end of the spring is attached to the gate and the other to the fence.—Frank W. Bentley, Jr., Missouri Valley, Iowa.

Make Your Trunk Moth-Proof

All the advantages of a cedar chest can be obtained by lining your old trunk with red-cedar shingles, which makes it moth-proof. This idea will appeal to many who need the protection provided by a cedar chest but cannot afford to purchase one.—Miss Durfe Rockwell, Hollywood, Calif.

Radio Scarecrow Saves Garden

A Michigan truck gardener and cherry orchardist is keeping destructive birds away by the use of a scarecrow and radio loud-speaker combination, the latter being connected to the radio set in the house. As long as it does the work, the owner says, he does not care whether he gets static or advertising.—M. W. Meier, Kalamazoo, Mich.



Outboard-Motor Boat, Driven over This Sturdy Rack, Can Be Pulled Out of the Water Easily

Rack for Outboard-Motor Boat

For anyone who has an outboard-motor boat, this rack will save considerable time and labor. It consists of a cradle for the boat, the keel fitting between two long strips running lengthwise, as shown. Crossbraces, attached to the center and outside pieces, provide the necessary rigidity, flat-head bolts being used to fasten them. The rack is pivoted at four corners on suitable pieces of hardwood, such as oak, or lengths of pipe, flattened at both ends. The lower ends of these pieces are pivoted to heavy pine stakes, driven into the bottom of the lake about 2 ft. The position of the rack, as indicated by the dotted lines in the upper detail, allows the boat to be driven over it, after which the rack is easily pulled out. —Bruce Zimmerman, Valley City, North Dakota.

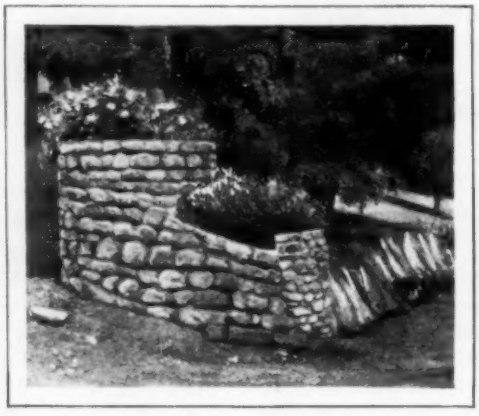
When using a tumbler for a hot beverage, set it in another tumbler so that it can be held in the bare hand.

Quick-Opening Gasoline-Tank Cap

The locking radiator cap used on model-A Fords can be applied to the gasoline tank without machine work, and makes a very good quick-opening cap which cannot be lost. The cap is screwed on the filler neck and held by the hollow setscrew as on a radiator. The only change to be made is that something must be placed in the hole drilled for the mototometer, and an air vent made in it. Any of the ornaments made for use with such caps can be used by drilling a small hole through the cap under the flange, or making a notch alongside the stem, and then filing a notch to the outer edge of the flange on the underside. A bolt having a flat nickelplated head can be used to retain the flat form of the standard cap if desired. This provides a vent which is shielded from rain. Of the two types of radiator caps furnished, the one on which the whole top turns to open is the better suited for use on the gasoline tank.

Garden Adds Beauty to Wall

A rough stone wall often will produce an impression of coldness, owing either to the kind or color of the stone used or to the method of laying it. In such cases, a flower garden on top of the wall usually will remove this impression. Earth pockets or troughs can be made on top and planted with one or more of the many varieties of rock-garden plants available.—H. Rossiter Snyder, Guilford, Connecticut.

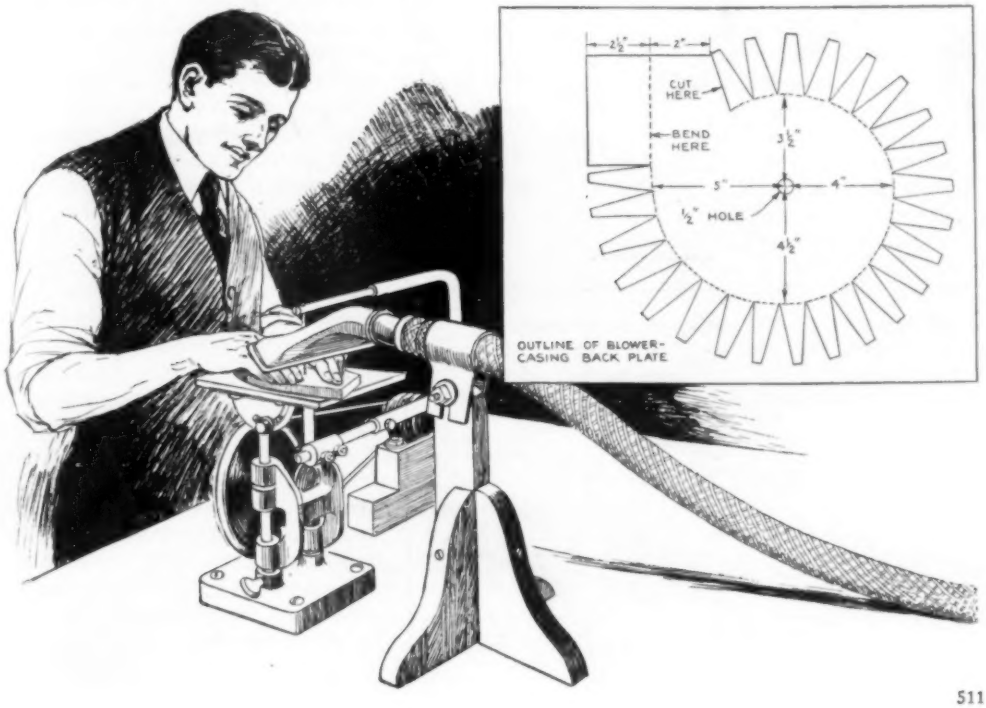


Garden on Top of Rough Stone Wall Makes It Much More Attractive

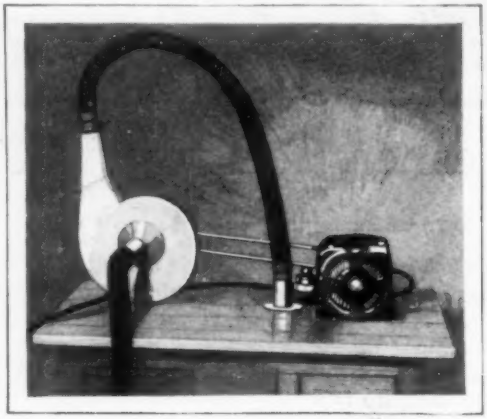
Vacuum Cleaner Removes Machine Chips

By M. CLYDE SMOCK, JR.

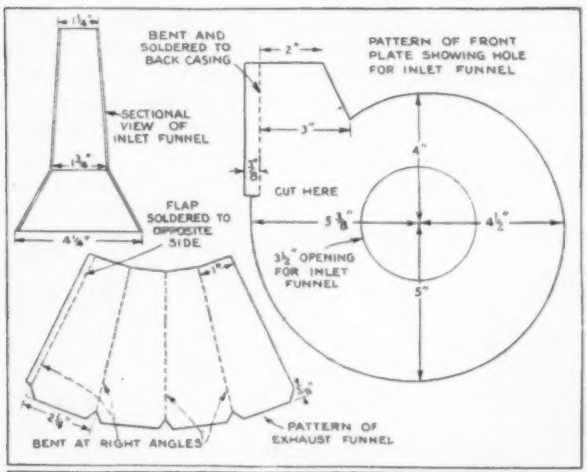
MUCH of the pleasure the home worker obtains in working with his motor-driven woodworking machines is marred by the sawdust and chips raised by them. Benches, machines and floor quickly become covered, and cleaning up is a job that must be performed immediately the worker is finished with every job, if the workshop is to be kept at all tidy. The idea of using some sort of vacuum cleaner to remove the sawdust and shavings as fast as they are formed came to the writer some time ago, and the result was the outfit described in this article. A regular vacuum cleaner would, of course, have served as well, but the household machine could not be spared from its ordinary duties, and, in the town where the writer is located, a secondhand machine could not be obtained at a reasonable price. So, since a ⅙-hp. motor was at hand, a blower was made from it as described. While somewhat crude in appearance, it is entirely satisfactory in performance, and seems as powerful as the regular vacuum cleaner.

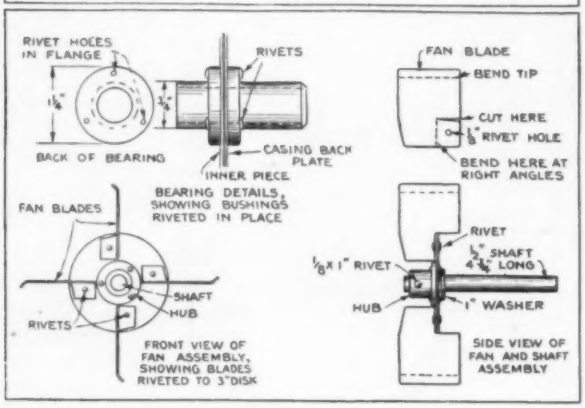


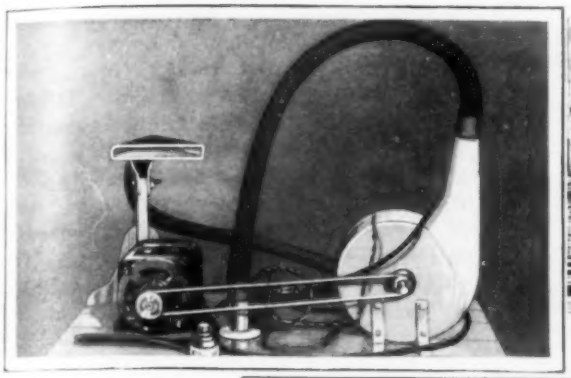
The blower-casing backplate was first cut out from heavy galvanized iron to the size and shape shown in the drawings; then the tabs were bent at right angles to the plate, taking care that the bend was not made too sharp. Next a piece of the same heavy-gauge iron was cut to fit inside the casing and riveted to the backplate with six flat-head tinners' rivets, 1 in. from the outer edge. From the same stock, a strip, 2⅜ in. wide, was cut to go around the outside of the casing, over the tabs. With a small C-clamp, the end of the strip was fastened to the end tab on top of the casing, the edge of the strip being flush with the back of the latter. The casing was then turned, with the tabs down, on a level surface, and solder was run in the groove where the strip and the backplate met. As soon as the solder set, the clamp was moved to the next tab, this was soldered, and the operations repeated until the entire strip was soldered around the edge of the backplate. In doing this, be sure to wash off the joint with running water after the job is completed to remove all traces of acid.

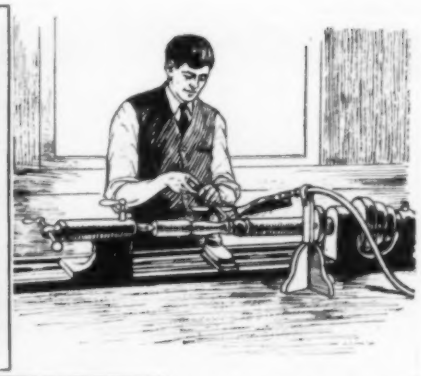


The casing was then laid, inside up, on the bench top, and a punch mark made, 3½ in. from the top and 4¼ in. from the right; then a ½-in. hole was drilled, using a ⅛-in. drill first to insure the ½-in. drill running true. The bearings on either side of this hole were made from two model-T Ford steering-spindle body bushings, reamed out to fit the ½ by 4¾-in. fan shaft used. Three ⅛-in. holes were drilled in each flange, the holes being drilled while the pair of bearings were held in the vise with the shaft through them, so that they would line up. The bearing holes were lined up on the backplate by first drilling one hole and then fastening the bearings with a ⅛ by ¾-in. stove bolt through this hole, while the others were drilled. One of the bushings is cut to a length of ⅝ in., and the end smoothed with a fine file; this is the inside bearing. The bearings are riveted to the backplate with the shaft in place to hold them in line. After riveting, solder was flowed into the joint between outer bushing and plate, to strengthen it. Two 3 by ¾-in. angle brackets were then bolted to the backplate.

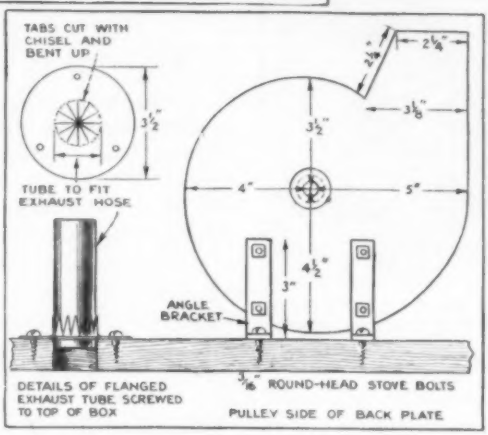

BENT AND SOLDERED TO BACK CASING
SECTIONAL VIEW OF INLET FUNNEL
FLAP SOLDERED TO OPPOSITE SIDE
BENT AT RIGHT ANGLES
PATTERN OF FRONT PLATE SHOWING HOLE FOR INLET FUNNEL
CUT HERE
3½" OPENING FOR INLET FUNNEL
PATTERN OF EXHAUST FUNNEL







Next, four fan blades were cut to the shape shown, care being taken that they were all of the same size, and riveted to a 3-in. disk of heavy-gauge metal, alining them opposite each other. They were fastened with a single rivet and then sweat-soldered fast. Another Ford bushing, similar to the bearings, formed the hub to which the disk carrying the blades was riveted. This was cut to a length of ¾ in. and pinned to the end of the shaft with a ⅛ by ⅞-in. stove bolt. The fan assembly was then slipped into place, first putting an iron washer over the shaft, between fan and bearing. It is necessary that the shaft run freely, and that the blades clear the exhaust opening by about 3/16 in.

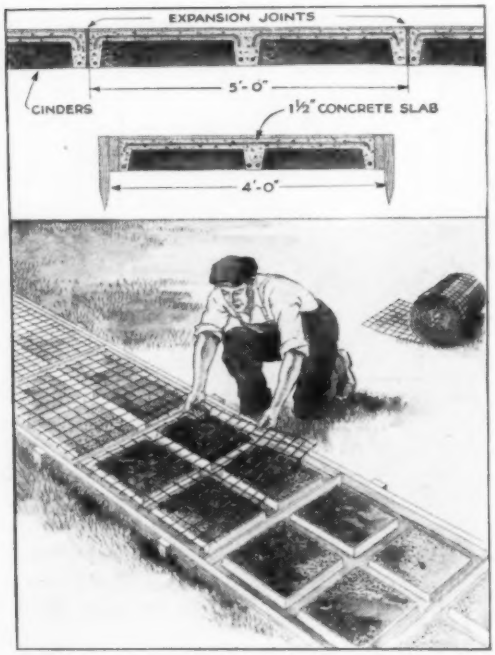


The casing was then turned face down on a piece of heavy sheet iron, and a pencil run around it to mark the front plate. This was then cut out, ¼ in. oversize all around, and a 3½-in. hole cut in the center, opposite the end of the shaft. It was clamped over the casing, and a heavy fillet of solder run in the angle formed by the ¼-in. projection and the side of the casing. A piece was cut to fit across the base of the exhaust outlet, with a flange on each side, and soldered in place, then the exhaust funnel was laid out, cut and bent to shape, and soldered in place, using plenty of solder. A 15-cent tin funnel was cut to fit over the 3½-in. inlet opening and soldered in place. As the funnel spout was too small to take a regular vacuum-cleaner hose, this was removed, and another, of a size to fit the hose used, substituted for it. The blower was now finished, with the exception of the pulley, which was selected to provide a speed of about 3,500 r.p.m. with the motor used.

The blower and motor are mounted on an old chest with a loose-fitting lid, into which the blower discharges the sawdust and shavings. It is not necessary to use a large box, however; one 12 by 14 by 18 in. is large enough. A special funnel is made to fit the circular saw, so that most of the sawdust is thrown into it, and is removed as fast as it forms. A stand similar to the one shown in the illustration will make it possible to place the funnel in the most advantageous position near the jigsaw and lathe, or any other machine for which the cleaner is to be used. The funnel can be tilted to suit.

"Alemite" Fitting on Grease Cup

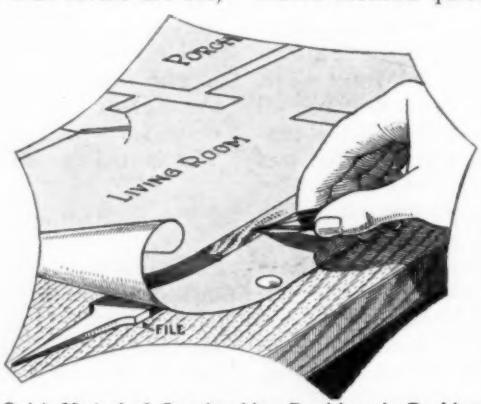
By installing an "alemite" fitting on an ordinary grease cup, you will find it an easier matter to fill the cup with a gun. All that is necessary is to drill and tap a hole in the cup cover to take the threaded part of the fitting.—R. M. Shelton, Dallas, Texas.



Reinforced Cement Sidewalks Require Less Material and Are Stronger Than Walks of the Usual Kind

Cement Sidewalks Reinforced with Wire

Ordinarily a cement sidewalk is a solid concrete slab ranging in thickness from 4 to 6 in. Concrete has very little tensile strength, and, if it is not reinforced with wire or rods, requires much more material in order to give it the quality in this respect. On the other hand, the compressive strength of good concrete is enormous, and therefore this reinforced and beamed walk is stronger than the usual kind, which is 6 in. thick. After the excavating has been done and the side forms are set, a form for the beams for one section of walk is placed beween the side forms and filled with cinders. The top of this form should be 2 in. below the top of the side forms, thus allowing ½ in. for topping. When the filling is thoroughly tamped, lift the beam form out and use it for the next section. Repeat this until the cinders are all in place, then place the wires for the beams as indicated, using No. 6 gauge wire. After that, the woven wire fencing for the slab is cut into sections and placed. Pour the concrete, using a piece of 6-in. lap siding, with the thick edge up, to form the expansion joint. When the concrete is set enough, the siding board is removed, the joint is filled with sawdust, and the topping is put on. The same method can be used for automobile drives, basement and garage floors and other work.—H. H. Siegele, Emporia, Kans.



Quick Method of Crosshatching Partitions in Drafting Building Plans

Pattern Color Indicates Material

A simple and practical method of informing the foundryman of which materials parts of a pattern are to be made is to have the different materials indicated by the color of the patterns, a chart being provided for reference. With this method, it is possible to avoid mistakes and to prevent the delay necessary to trace the pattern back to the original drawing. A color scheme of this kind, which was found to be of considerable assistance in a foundry, is as follows: Black for cast iron, gray for steel, yellow for brass, red for copper and white for aluminum. The color used on the pattern was as close to the natural color of the metal as possible.

Draftsmen Use File for Crosshatching

Architectural draftsmen and others who have occasion to crosshatch partitions in penciled building plans, will find the illustrated method quick and useful. Just lay a small flat single-cut file under the section to be crosshatched and hold the paper over it, then use a pencil as in shading.—G. M. Beerbower, Tarrytown, N. Y.

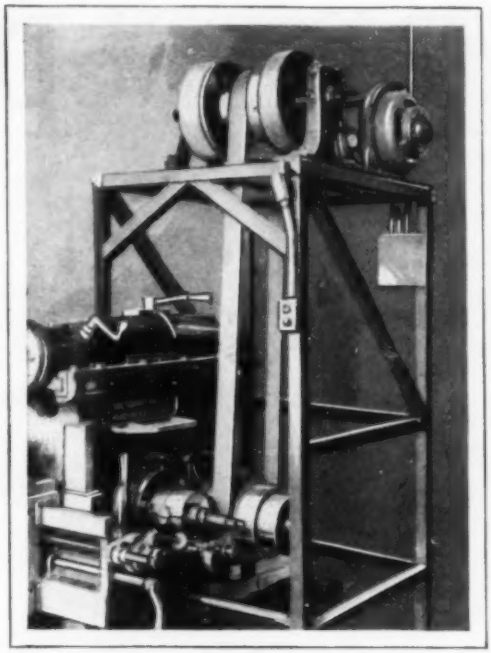
¶Clean a dirty crack of a casting with a piece of caustic (handled with care) and it can be welded at once.

Air Supply in Fords at High Speeds

The high speed of the Model-A Ford is partly dependent upon an adequate supply of air in the gas tank at all times. This source of supply is normally received through small openings in the double shell of the cap which screws upon the opening on the bonnet. These, though small, can usually be seen upon examination. Because of the small size of the openings, these frequently become clogged with dirt, and are difficult to clean in an effective way. Air pressure, the most effective cleansing method, is difficult to apply with ordinary apparatus. In consequence, the supply of air decreases, and in rare instances is entirely shut off. The result is that, at high speeds, the gasoline is momentarily drawn into the carburetor faster than air comes into the tank, and the pressure is lowered. The gasoline supply to the carburetor is then cut down or ceases entirely, causing the car to stall. This normally occurs at speeds above 45 miles an hour, though this is dependent upon the condition of the cap. Considerable experiment has provided only one infallible remedy. A hole is bored in the top of the cap, about 1/16 in. in diameter, and this is utilized for air supply. The hole should be drilled downward, to prevent roughness around the edge.

Double Handle for Two-Spindle Drill Press

A drill-press handle, suitable for operating both feed levers of a double-spindle drill press, can be made up from pipe and fittings as shown in the drawing. This tool relieves the operator of the necessity of using both hands to feed the drills, leaving one of them free to set the parts under the drill or to hold them, and also to lubricate the drills.



Individual Motors for Machines Supported on Frame Made of Steel Tubing

Frame for Individual Motor Drive Straddles Machine

As a step in eliminating all the long shafts and belting in a machine shop, a number of individual motor drives were substituted. On some machines a special frame or support was necessary to hold the motor as shown in the photo. Ordinary square steel tubing is used in constructing the frames, all the joints being welded.

Phonograph Needle Cuts Glass

Fit a phonograph-needle holder in a suitable handle as shown in the illustration and insert a sharp needle. This will be found handy as a glass cutter. When dull, the needle is easily replaced.—Henry B. O'Connell, New Haven, Conn.

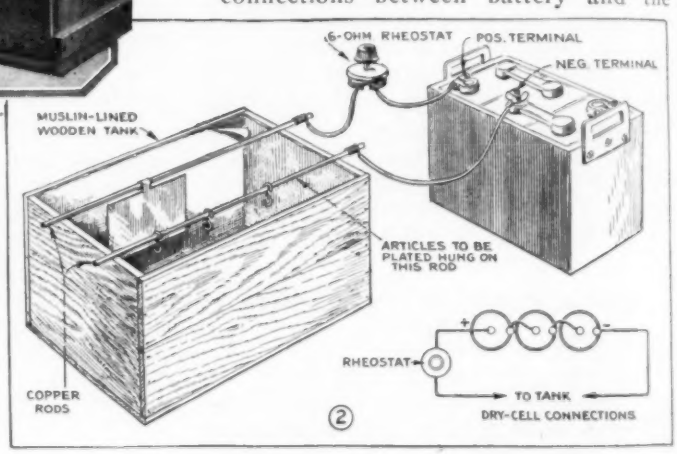
¶A newly tapped hole should be oiled before turning a bolt into it.

Effective Plating Tricks

A WOOD box lined with wax, two or three cells from a wet battery, some metal and a few chemicals, and you are equipped to turn out beautiful pieces of metal-plated work or permanently protect your pet tools against the ravages of rust and corrosion. You can even have the distinction of owning a goldplated steel rule, micrometer, calipers, dividers and other workshop necessities. Although gold is justly considered a rare and expensive metal, the thinness of the plate required reduces the cost to a few cents for each article plated. And then, for less pretentious work, there is silver, nickel and copper. All of them can be plated by a simple electric process or chemically with a camel's-hair brush.

For the electroplating process, make a small wood box, larger than the largest object that is to be plated. An 8 by 12 by 6-in. box is satisfactory for average small work. See Figs. 1 and 2. Line it with good quality muslin and then cover the entire inside with a thick coat of hot paraffin wax, to make it water and acid-proof. Lay two copper rods in notches across the top to serve as electrical connectors and supports from which the metal and objects to be plated are suspended.

Wet-cell batteries are used, and as the construction is so well known, it need not be repeated here; cells from old A or automobile batteries can be used if they give the proper voltage, which is about 3 volts and 4 or 5 amp. A radio rheostat makes an excellent current control or regulator. Solder the wire connections between battery and the two copper rods atop the plating box. For very small jobs, dry cells may be used, but they are not recommended.



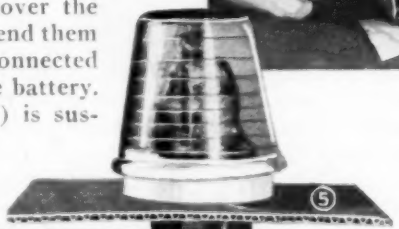
An important thing to remember is that anything to be plated must be chemically clean. And after cleaning, it is important that no fingermarks are made on the work as they invariably show as a fault in the plating, which would have to be done all over again. First see that the article is perfectly smooth; it can be made so by polishing. Then boil it for a few moments in a solution of ordinary washing soda. In the case of steel or iron, dip next in a weak sulphuric-acid solution

Easy To Do

by K. B. Murray

and rinse in pure water. Steel or iron also requires a thin plating of copper before it is plated with gold, silver or nickel, to make the latter adhere tenaciously. Finally dip the article in a nitrate-of-mercury solution, and it may be placed in one of the following plating baths: Gold solution; dissolve ½ oz. gold chloride in 2 qt. distilled water and add 1½ oz. potassium cyanide. Silver solution; in 2 qt. distilled water dissolve 4 oz. potassium cyanide and 3 oz. silver cyanide. Nickel solution; to 100 parts distilled water add 6 parts nickel sulphate and 3 parts ammonia water; when this is dissolved, add 20 more parts ammonia. The bath is to be kept alkaline. Copper solution; to each quart of saturated solution of copper sulphate add ¼ oz. sulphuric acid.

Enough of the solution is poured into the plating box to cover the articles to be plated. Suspend them on the bare-copper wire connected to the negative pole of the battery. The plating metal (anode) is suspended from the other rod by means of another copper wire, which in this case must not touch the solution, or else as shown in Fig. 2. In copperplating, a sheet of copper is used; with expensive metals, such as gold and silver, a small piece can be easily pounded out into a very thin flat plate, which will present greater surface to the solution.



Nickel is used in the same manner as copper, but as the pure metal is sometimes difficult to secure, a plain piece of platinum wire may be used as an anode. As no nickel will be passed into solution to take the place of that used in plating, more nickel sulphate must be added as required. This obviates the necessity of investing in a large anode of the metal, which is many times more than required for occasional work.

The time required for plating is determined by the strength of the battery, space between the electrodes and temperature of the solution. If the plating appears granular, more current must be used; a higher amperage rather than higher voltage. If it appears dark and burnt, the current is too strong. The shorter the distance between electrodes in the plating solution, the less time is re-

quired. It is obvious, however, that the articles nearest the plating metal will receive the heaviest deposit, so they must frequently be moved about. The connecting wire must also be moved occasionally to avoid markings. When to remove the articles from the solution is determined by inspection. They should be rinsed and dried and then polished. Gold and silver-plating can be easily given a high polish with a soft chamois free of grit. A buffing applied to nickel will bring out its full brilliance.

In handling and making solutions containing the cyanides, the utmost care must be used as they are deadly poisons. Mark the cyanide bottles plainly and keep in a secure place.

Through constant usage silverware commonly wears at a particular place, exposing the base metal underneath. The spots can be easily and cheaply touched up in the following manner: Make a saturated solution of silver nitrate in distilled water, then add to this, one drop at a time, some ammonia water. The solution is ready for use when the brown color just disappears. Apply this solution to the worn spot with a camel's-hair brush, as in Fig. 3, at the same time touching the spot with a scrap of bright zinc. This should be repeated five or six times, when the spot will look dark and tarnished. It is now dried and gone over with a soft cloth, then polished with a cloth and whiting, when the new silver will be revealed in a beautiful satin finish.

Tools with flat surfaces can be coated with silver or gold by a heat process. Heat the metal to a blue color and apply evenly a piece of gold or silver foil or leaf. This is then burnished by rubbing with a smooth surface, such as glass or a polished stone, as in Fig. 4. The plating is extremely thin, but in ordinary use will last for years. It is not, of course, suitable for specially tempered articles.

A simple gilding solution can be made with gold chloride, dissolved in as little distilled water as possible and added to an equal quantity of ether. Painted on chemically clean steel or iron, it deposits a film of gold, and several treatments will give a wearable plating that is useful for watchcases, rings and other jewelry.

Often it is desired to gild plastic casts, polished wood, cloth or paper. With the following solutions either gold or silver can be used. Make up the solutions with gold chloride or silver nitrate in distilled water and paint the objects to be gilded or silvered. Then place them inside an upturned glass jar (Fig. 5) into which hydrogen gas is injected. The hydrogen will throw the silver or gold out of solution and deposit it on the objects. Hydrogen gas is made with a weak sulphuric-acid solution in which has been placed filings or clippings of zinc. The gas is given off in small bubbles and quickly rises to the top of the container. It should be made away from open flames. In Fig. 5 the gas passes from the lower glass into the upper through holes in the cardboard.

One of the handiest uses to which electroplating can be put in the home workshop is in the making of unusual metal nameplates, as in Fig. 6. They can be made on squares of copper, steel or brass, or directly on tools themselves, where they are decidedly unique. The ground should be of a metal contrasting in color

with the lettering. Therefore, as an example, paint in the lettering with copal varnish and, with the electric or chemical-plating method, cover the plate with a film of gold. Remove the varnish with alcohol, dry with a soft chamois and paint the ground (excepting the lettering) with

varnish. Place it in a silverplating solution until the lettering is coated with silver. Remove the varnish as before, and you have a beautiful nameplate lettered in brilliant silver on a gold ground. It may be dipped in thin lacquer, as a protection against scratches.

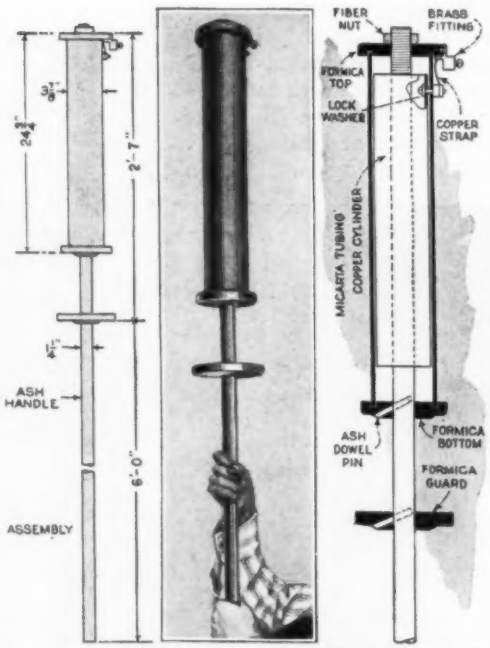
Copper lends itself very well to chemical color treatment, and with the following simple process, up to a dozen different colors and shades can be secured. Make up the following solution: lead acetate, 300 gr.; sodium hyposulphite (hypo) 600 gr.; water, 1 qt. Heat the solution and immerse the object to be colored. Watch the latter closely; as the solution becomes hotter, it will pass through a number of colors and shades, one after the other. When the copper is of the color desired, remove it at once from the solution, rinse and dry carefully. The chemical color forms a tough coat on the surface of the metal.

With silver electroplating you can have tumblers, wine glasses, pitchers, etc., of a beauty and exclusiveness seldom seen. Ordinary glassware is used, but when you have finished, it has a thick outer plating or shell of pure silver, with a plain glass interior or gold-lined interior as you wish. The cost is not prohibitive.

The glass must first be "silvered" or "gilded," according to whether you desire a gold or a silver covering. As the two processes are alike, the silvering will be described. For gold, gold chloride is substituted for silver nitrate. First wash the glass with dilute nitric acid and rinse with distilled water. After this the glass must be handled with care, with the fingers inside, to prevent fingermarks on the surface. Make a saturated solution of silver nitrate and add, a drop at a time, some liquid ammonia. Stop when the precipitate at first formed is dissolved again. Turn the glass upside down, Fig. 7, and cover the bottom with the silver solution. Add one drop of formaldehyde, and stir with a toothpick. The solution will become dark, and a film of silver will be deposited on the glass. Do not touch it, but pour off the solution, and if the coating of silver does not cover the entire bottom, repeat the process.

To silver the sides the same method is used except that only a small portion is silvered at a time. To do this, a rubber wall must be formed about the space and silver solution poured into it. Small tumblers can be entirely silvered in one operation, as shown in Fig. 8. A waxed-paper tube is placed about the upturned glass, and several spoonfuls of the solution will cover it.

When the outside is entirely silvered, without scratches or pinholes, it is ready to be electroplated. Fasten adhesive tape to the inside, Fig. 9, so that the tumbler can be suspended from the copper rod in the solution. The connecting wire makes contact with the silvered surface at the mouth of the tumbler by means of a piece of tinfoil clamped over the edge. In a short time, move the tumbler about so that all sides will be plated evenly, and frequently move the connecting wire and tinfoil to a different place on the rim so that there will be no markings. When the glass is heavily silverplated—at least the thickness of several sheets of paper—dry and polish it with soft chamois skin.



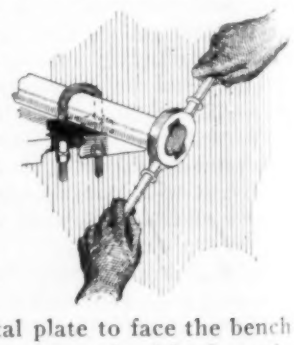
This Indicator Stick Protects Linemen from Dangers Involved in Working on High-Tension Lines

Device for Indicating Live Power Lines

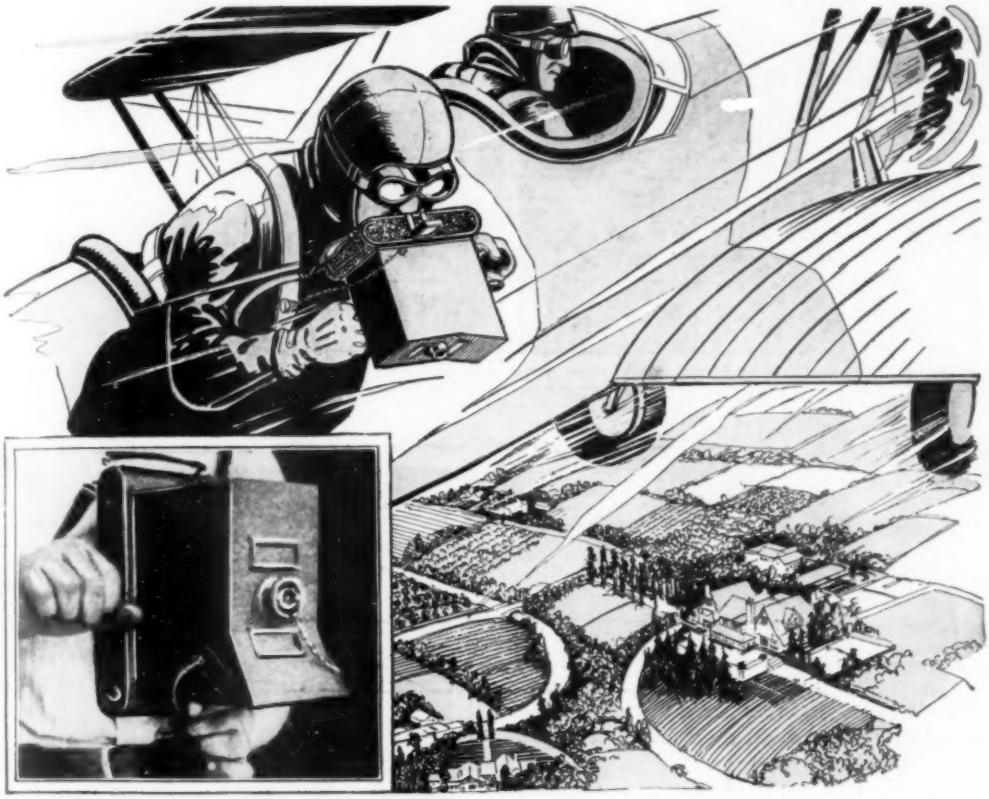
An interesting live-wire indicator stick, which is shown in the drawing and photo, has been put in use by an eastern electric light and power plant. When working on cables it has been the practice of this organization to place grounds on all three conductors at both ends of 13,200-volt lines. But if the workmen are not sure that the cables are dead, there is considerable danger involved. With the use of the indicator, however, this trouble is eliminated. It consists of a piece of micarta tubing inclosing a copper tube, connected to a binding post and a brass contact on the formica cap of the tube. Weighing only 7 lb., the stick is easily carried about where needed. When the metal contact touches the conductor carrying 13,200 volts, and is then drawn away, there will be a spark approximately ½ in. in length. The noise of the spark is exceptionally clear and serves as an indication of the presence of current even though the spark may not be seen. It is claimed that a reliable indication is given on a three-phase circuit with a potential as low as 4,000 volts, even when the frequency is as low as 25 cycles.

Improvised Pipe Vise Made from Cable Clamp

For pipe of small diameter, an improvised vise can be made from a cable clamp as shown in the illustration. A number of file or hacksaw cuts are made on the inside of the clamp to give it the required gripping edge, and the threaded ends are then pushed through holes drilled in the bench top, after which nuts are run on. Of course, it is necessary to provide a similarly drilled metal plate to face the bench top drilled to correspond with those in the bench top. When securely tightened, this vise will hold the pipe as well as a regular vise.—Raymond B. Wailes, Bethesda, Md.



SMALL CAMERA EASY TO CONVERT FOR AERIAL USE



If Used on Clear Days Only, This Cheap and Simple Aerial Camera, Made from an Ordinary Postcard-Size Camera, Will Be Found Perfectly Satisfactory; Inset Shows How the Camera Is Held for Vertical Pictures

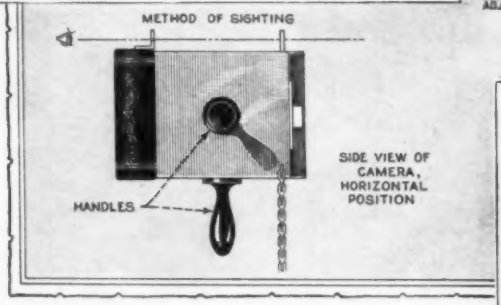
By R. F. STARZL

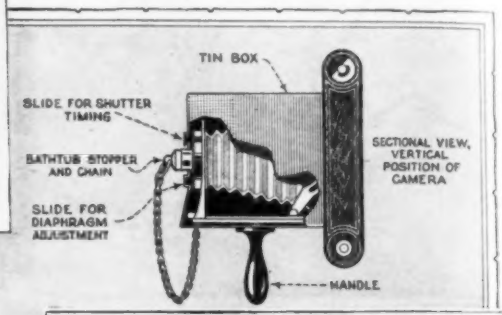
NOW that nearly every little city has an airport of some kind, and every small town its airplane owner, a new source of revenue is opened to the photographer, whether amateur or professional, who is alert enough to cash in on the new public "airmindedness."

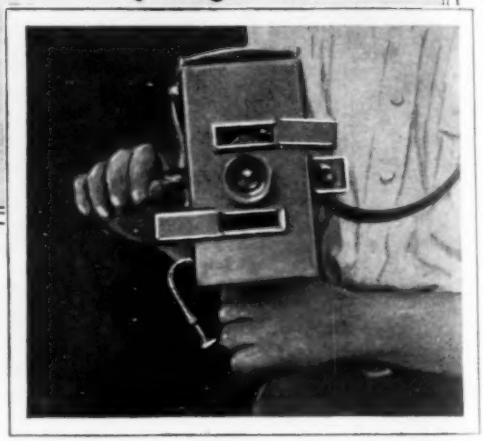
In many parts of the country, flying photographers have made handsome profits by arranging to make aerial photographs of prosperous farms, country estates, or the small cities and towns themselves. The field of commercial aerial photography has hardly been scratched, however, as far as the ordinary photographer is concerned, because of the cost of regular aerial cameras. Ordinary cameras cannot be used because the powerful blast of air along the ship causes the bellows to flutter, and looking into the ordinary top view finder is out of the question except for the most daring.

The illustrations show how an ordinary postcard-size camera was converted into a satisfactory aerial camera for such work as outlined above, and similar methods can be used for cameras of other sizes and types. First the camera was focused at 100 ft. or "infinity." Then a box was made of sheet metal to fit over the camera with the bellows extended to this focus. Handles were attached to one side and to the bottom, as shown, the handles, like the box itself, being fastened to the camera with small screws and rivets.

Simple slides were fitted over openings cut for the shutter-timing and lens-opening adjustments. These are not essential, but they prevent a certain amount of air from reaching the inside of the case while







"shooting" a picture. As a finishing touch a bathtub stopper on a chain was fitted as a lens hood.

For all practical purposes, an f.8 lens can be left wide open, and the shutter timed at one-twenty-fifth second. Sighting is done by means of a bead sight and a clear-glass screen with cross lines scratched on it, mounted at the rear. Both bead sight and glass finder should be on hinged mountings, as on a Graphic camera, so that they can be folded flat to the case. The sights are on the side of the camera, but can be used for vertical pictures as well.

Provided this outfit is used on clear days only, pictures taken with it are perfectly satisfactory, and its low cost puts it within reach of anyone who may hanker to snap pictures out of an airplane cockpit.

Tinning Black Iron

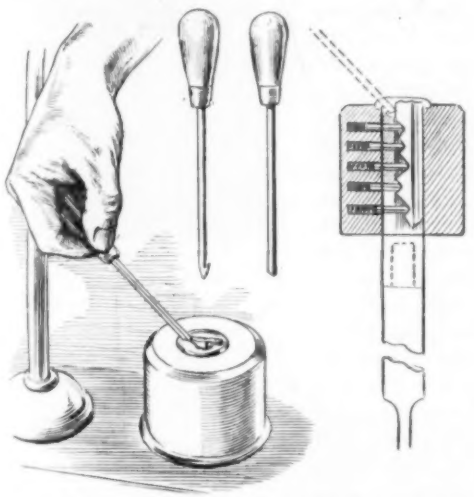
For tinning black-iron and steel objects, in order to prevent them from rusting, the following method has been found very satisfactory, leaving a thick deposit: The scale on the surface is first removed by immersing the object in raw muriatic acid until the metal turns white. It is then put into cut muriatic acid, which is made by adding clippings of sheet zinc to raw muriatic acid, until it will dissolve no more. The cut acid leaves a zinc film deposited on the surface of the work, so that the molten tin will adhere better. After shaking off the surplus acid, the object is dipped into the molten tin, solder or lead, as desired. If the coating is not satisfactory, dip the object into the cut acid and molten metal again.

Old Tires Aid Road Grader

Finding that the flat steel-band tires of a road grader tossed dust in his eyes, the operator took some old auto casings, trimmed off the beads and cut them across so that they could be snugly fitted to the wheels. The cut ends were spliced together with wire. As the wheels were larger than ordinary auto wheels, it was necessary to use more than one tire to each wheel.—Dale R. Van Horn, Walton, Nebraska.

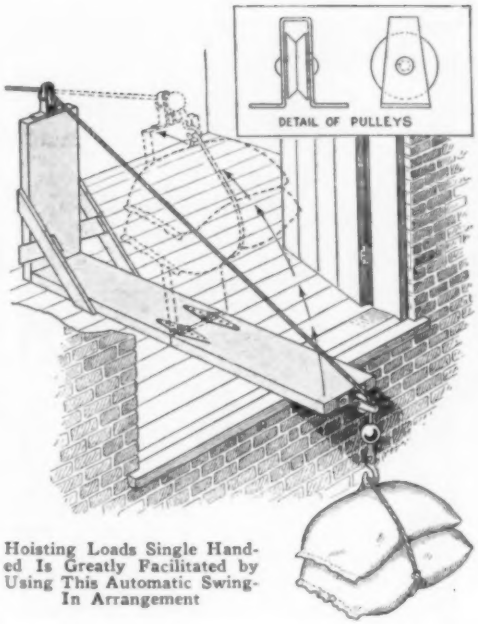
Tools for Removing Broken Transmission Keys

With the tools shown in the drawing, it is an easy matter to remove broken transmission keys, according to an expert in a large lock factory, who takes care of auto-lock repairs. Each tool consists of a thin piece of steel, set in a suitable handle, the end of one being cut off at a bevel and the other ground to form a hook. The former is used to pry the key up as indicated by the dotted lines in the right-hand detail, which is done after the key is in the correct position to permit its removal. It will be found handy to have a couple of tools of the bevel-end type, so that one can be used to hold the key while the other is inserted for a new bite. With some types of locks, there is enough space for the hook-end tool to be slipped under the first notch of the key, after which the key is merely pulled out. Before using the tools, one should be sure that the lock is against the stop on either side. It has been found that over 90 per cent of auto-lock trouble is caused by oil gumming or by paint and varnish being inadvertently dropped on the lock. Never apply oil to the lock, but lubricate it with powdered graphite or with a mixture of graphite and tire talc in equal parts. Gasoline poured into the lock will help to clean out



Broken Keys in Auto Locks Can Be Removed with the Aid of These Tools

gummed oil.—E. M. Spooner, Hartford, Connecticut.



Hoisting Loads Single Handed Is Greatly Facilitated by Using This Automatic Swing-In Arrangement

Automatic "Swing-In" for the Hand Hoist Convenient for Single Worker

Often the only available method of raising bags of material to an upper floor is by means of a pulley and rope. The objection to this method is that the bags must be swung in and landed on the floor before taking them off the hook. When a man must hoist the bags and unload them alone, the automatic swing-in shown will be found convenient. A 12-in. plank is fastened to the unloading platform and another length is hinged to it as indicated. An upright piece is fastened on at right angles, being securely braced to the stationary plank, and two inclosed pulleys are mounted, one on top of the upright and the other on the end of the hinged plank. The rope is passed over the pulleys and a ball weight is used just above the hook. The operator pulls on the rope in the usual way to raise the bag but, when the ball weight strikes the pulley on the hinged plank, the plank is also raised and swung over to the position indicated by the dotted lines, depositing the load safely on the floor without the least trouble. —Harry Moore, Montreal, Can.

¶A little kerosene, poured into a box before running in the babbitt, will prevent the explosion that sometimes occurs.

Work of Punch-Press Operator Made Easier by This Adjustable Table Attached to Truck

Adjustable Table for the Punch Press

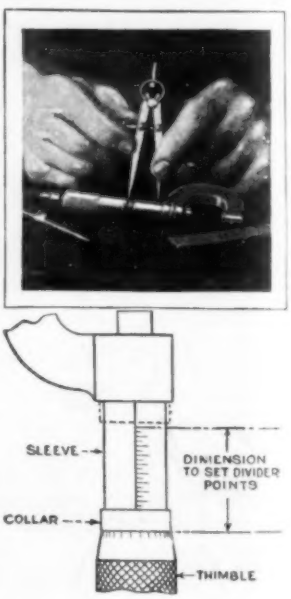
A truck having an adjustable table helps to promote efficiency and reduce fatigue of punch-press operators. The table, which is made of wood, is attached to two pipes arranged to slide within two other pipes fastened to the truck by means of floor flanges. A series of holes in both sets of pipes enables the operator to adjust the table to the desired height. The stock to be punched is placed on the table, and when one batch has been used, the operator simply picks up another batch from the truck and places it on the table.—A. Mathieu, Chicago, Ill.

A Tip for Draftsmen

When the surface of a drawing board becomes badly scarred from thumbtack holes, the surface can be restored by covering the board with "battleship" linoleum. This is very thick linoleum, that comes usually in plain colors, gray, brown or green, and offers a very good drawing surface. Furthermore, it can be washed with soap and water without injury or "raising the grain." In addition, when a thumbtack is withdrawn, the hole closes tightly and leaves no mark. It is best to fasten the linoleum to the board with hot glue, but small-headed tacks at the corners also will hold it securely.

Micrometer Collar Enables Correct Setting of Dividers

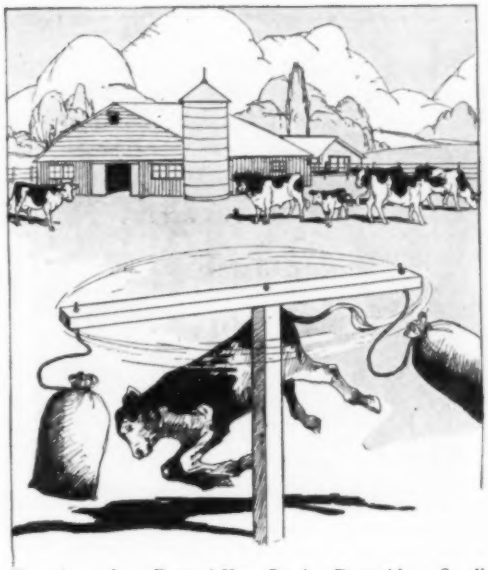
To insure accuracy on many classes of work, dividers should be set to decimal readings, but, in the absence of any proper tool for this purpose, most mechanics resort to a scale, and set the divider points as nearly as possible to the correct measurement. It is easy to obtain an accurate reading, however, which involves no guesswork, by using the graduations on a micrometer and by adapting a collar, as shown in the photo and drawing. Upon examining a micrometer, it will be found that the edge of the thimble is about 1/64 in. larger than the sleeve. A collar is made to be slipped on the sleeve, of such thickness that the outside surface will come flush with that of the thimble, and it should be slightly less in width than the distance from the frame to the zero mark on the sleeve so that it can be slipped out of the way when not needed, as shown by the dotted lines. To assemble the collar, screw out the thimble entirely and slip the collar on the sleeve. Then, supposing that the dividers are to be set .865 in. apart, turn the thimble to this reading, slide the collar up to touch it and set one leg of the dividers at the zero mark and the other in the line formed by the edges of the collar and thimble. The collar provides a non-slip mark for the dividers.—Harry Moore, Hamilton, Can.



Tamping Explosives

Metal tools of any kind should never be used for tamping explosives in bore holes, or to press the charge into place, even in soft ground, as there is always the danger of striking a pebble, which might produce a spark sufficient to ignite the charge. For loading and tamping, use a wooden stick; for shallow work, an old broom handle is ideal; for deep holes, a straight sapling can be used to advantage. For tamping horizontal holes, where a heavy stick of oak or hickory would be difficult to manipulate, one of light wood, such as pine or bamboo, is desirable. Bamboo fishing poles make ideal tamping sticks under these conditions. It is positively dangerous for a powerful man to ram a charge of high explosives into a bore hole with a heavy stick, even if it is made of wood. In deep holes, a very long, cumbersome tamping stick would be necessary, so a block is used in holes that are vertical, or nearly so. This consists of a round piece of wood, from 3 to 6 ft. long and a little smaller in diameter than the hole. A rope is attached to the center of one end, by boring a hole diagonally from the center out through the side, countersinking the hole on the side, then threading the rope through the hole from the end, knotting it and pulling it back, so that the knot is drawn into the countersink and does not interfere with the sliding of the block in the hole. The block should be made of hardwood, to resist wear no metal parts should be used, and it should not be too heavy. It is operated by raising it 1 or 2 ft. and allowing it to drop on the stemming. The block is pulled out when fresh stemming is dropped in.

¶When cutting irregular shapes of labels, etc., place the paper on strawboard or bookbinders' board, and by moving the board carefully no back gauge will be required.



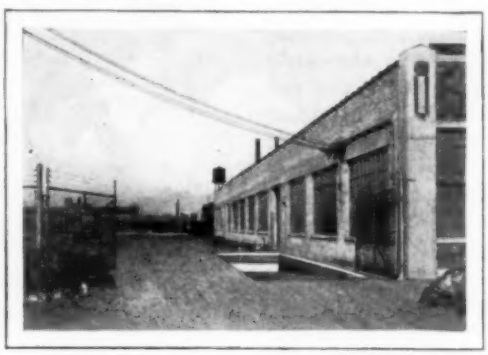
Exerciser for Penned-Up Stock Resembles Small Merry-Go-Round

"Merry-Go-Round" Exercises Stock

For exercising penned-up stock, a western farmer built the "merry-go-round" shown in the drawing. It consists of a 10-ft. length of straight-grained 2 by 4-in. stock, set on a pivot on a suitable post; on each end a canvas sack, filled with sawdust, was suspended. The animals push the sacks without danger of injury. Young colts and calves have been observed spending several hours at play in this way.—F. W. Fickle, Seattle, Wash.

Pit Substituted for Loading Platform

When it was found impossible to build a loading platform at a small factory, a pit was substituted. It was built of concrete and has large wooden bumpers. Trucks back into the pit, which is located next to the receiving room, and the load is removed from the back. The truck floor comes about level with the ground, making it easy to transfer the heavy material.



Inclined Pit Has Proved a Good Substitute for Loading Platform

Storage Bins from Empty Cans

Empty powder cans or similar containers make convenient bins for storage purposes. Half of the head of each can

Stack of Metal Cans with Covers Partly Removed, Provides Storage Space for Parts

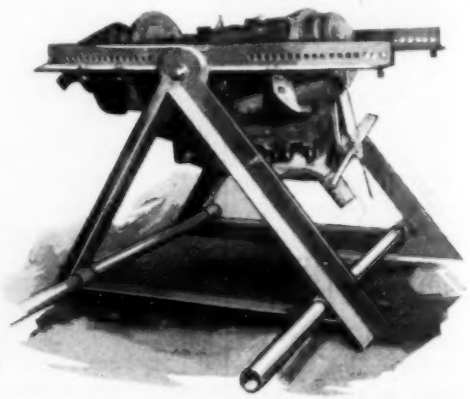
is cut away at one end and the cans are then stacked as shown in the photo. In this way as many bins as required can be provided quickly and removed when no longer needed. By keeping the cans painted, they look neat, and, if desired, labels may be used to designate the kind of material stored in each.

Aircraft Streamlining

Proper streamlining is an important factor in the construction of all types of aircraft, and modern builders spare no expense in streamlining their products as perfectly as possible in order to obtain better performance. Stock airplanes to be flown in a race are sometimes "souped up" by covering all fittings and small projections with putty so as to present as little resisting surface as possible to the air stream. This system obviously has its limitations, because putty will not adhere to a large surface and, if used too generously, will add materially to the weight of the airplane. For the amateur racer or airplane builder who does not possess the money or equipment required to fit his ship with the latest in sheet-metal streamlining, an excellent material for this purpose may be prepared as follows: Mix sawdust and ordinary wing-fabric dope in the proper quantities to give the resulting mass the consistency of putty. (Fabric dope may be procured in unlimited quantities at any airport.) Apply the material, by hand, to the part to be streamlined and mold as nearly as possible into the desired shape. The material dries very quickly and will be quite hard in a couple of hours. It may then be dressed down as desired with a wood file. If a really factorylike job is wanted, the part may be further dressed by adding several coats of dope mixed with very fine wood powder, such as may be procured from wood-grinding wheels in any woodworking shop. Pigment may be added if color is desired. Besides being easily molded to any shape desired, this material is light in weight, has a smooth hard surface and adheres tenaciously to any part to which it is applied. —Lieut. W. R. Wolfinbarger, Langley Field, Virginia.

Handy Stand for Repair Shops

For welding and other repairs on auto engines, a western repair shop finds the movable stand shown in the photo of considerable utility. It consists of a 3-ft. welded triangular frame of 3-in. angle iron, with spacing crossbars of pipe welded in at the bottom. Each section of pipe is 2 ft. long, and those at one side of the stand slip into those at the other side and fasten with setscrews in a welded projection at the end of the outer section. This arrangement allows the stand to be adjusted to any necessary width. At the top, a 6-in. circular plate of steel, ¾ in. thick, is welded in at each side of the frame. A similar plate is welded to

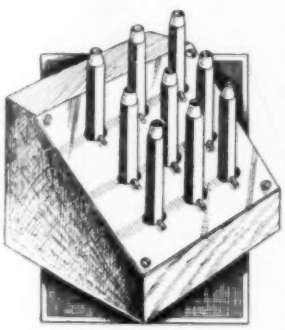


Homemade Adjustable Stand for Holding Auto Engines to Be Repaired

each of two horizontal 3-in. angles, and by means of a stud through each pair of plates, the engine may be tipped and locked in any desired position. A short block of ½-in. steel is welded between the inside disk and the top edge of the angles to make the latter rigid, and ¾-in. holes in both vertical and horizontal flanges of the angles permit an engine to be set up on the stand merely by fastening it with a bolt at each corner.

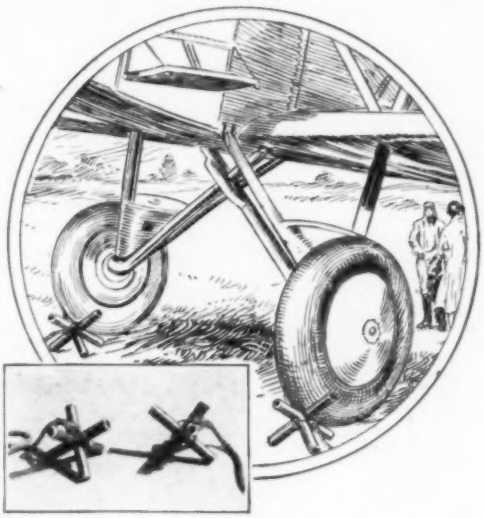
Self-Alining Stamp Holder

Steel stamps, either letters or figures, are confusing when they are not straight in the holder, as a "5," for instance, looks much like a "3" when turned around. It is handy to have the stamps all straight and facing the user, but it is not to be expected that everyone in the shop will put them back in that position. However, the holder illustrated will automatically take care of this. It is made from a square block of hardwood, drilled to receive the stamps and faced with a piece of sheet metal attached with screws, the top portion of the block being cut off at a bevel. Each stamp has a pin driven into the side near one end, so that when the pin points toward the front of the block, the letter on the stamp will be easily recognized. Naturally, when a stamp is inserted into the holder, the pin slides around on the beveled surface until it points toward the front as shown, and the letters all face the user.—Harry Moore, Montreal, Can.



Run-Up Blocks for the Airplane

For use when warming or "running up" an airplane motor, the blocks shown in the illustration will be found convenient. They are made of heavy-gauge steel tubing, welded together in the form of a six-point star. It has been found that the most efficient size for universal use is a length of 5½ in. for each leg. Blocks

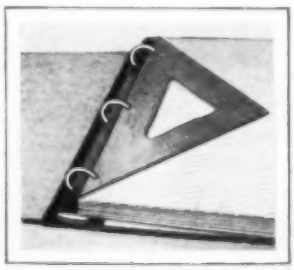


These Run-Up Blocks Are Made of Steel Tubing and Will Not Jam or Slip

of this type have been in use at the Denver municipal airport for six months and have been found to hold any pair of wheels regardless of tire size. They can be used on either dirt or concrete surfaces, will not jam after the motor has been run up, and will not slip even on ice.—L. D. Richards, Denver, Colo.

Keeping Track of Drafting Triangles

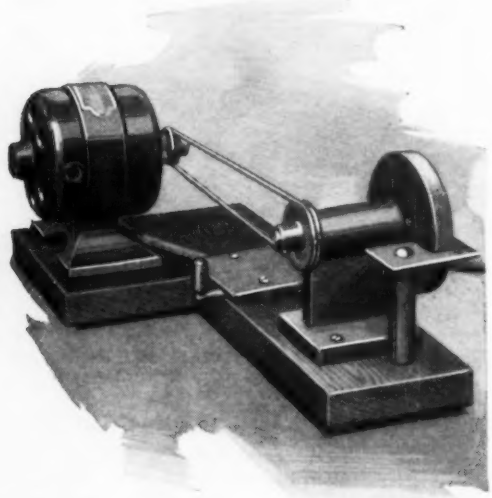
In order to avoid misplacing drafting triangles, one engineer, who had occasion to carry them with him for use in field work, solved the problem by drilling holes in them so that they would fit the fasteners of a loose-leaf note book as illustrated. This method is especially recommended to those who have to carry their equipment around with them.—Edward H. Flaharty, Parco, Wyoming.



¶When brushing chips and dirt from a machine, be careful to keep them from falling into journals or parts where they will cause injury.

Small Emery Grinder for Home Shop Made from Odds and Ends

One of the most useful tools in the writer's little shop is a small motor-driven emery grinder that was made up mostly



Small Belt-Driven Grinder Especially Designed for the Home Workshop.

from odds and ends around the place. It is the outcome of a good deal of experimenting. At first thought it would seem much better to mount the grinder directly on the motor shaft, as is often done, but this placed the wheel in a rather awkward position for many grinding jobs, and the dust gets into the motor bearings, causing considerable wear. Besides, the weight and vibration of the wheel also damaged the bearings, which had to be renewed as a consequence. The motor is a small one of the high-speed type. Running free, it will turn about 8,000 r.p.m., but driving the wheel, it is held down to about 4,000. It drives the wheel by means of a 3/16-in. steel-wire belt. A leather belt small enough for the job could not be made to do the work at the high speed required. The driven pulley is 25 per cent larger than the driver; both are turned from brass and are deeply grooved. The emery wheel, 4 in. in diameter, is mounted on a 3/8-in. tool-steel shaft and fitted with the greatest care into a very long bearing in a cast-iron bracket, which was found in the junk box. Lubrication being of vital importance, special provision was made for automatic oiling. At the middle of the length of the bracket, a 3/8-in. hole was drilled down from the top, the drill passing through the shaft hole and going 1/2 in. into the iron below it. Both holes, above and below the shaft, were then packed with felt. The hole at the top was closed by fitting a swinging cover of sheet brass. With this arrangement, a single soaking of oil will last for a long time, and there is no excess or leakage. At the same time the upper piece of felt keeps stray dust out of the bearing. Equally important is the sealing of the ends of the bearing against leakage of oil and intrusion of dust. The ends of the bracket are true and square with the hole for the shaft. Excessive end play of the shaft is prevented by the driving pulley at one end and a large collar on the shaft at the other. In the inner faces of both pulley and collar, deep annular grooves are turned to receive thick felt washers. When the pulley is so adjusted that the shaft has just the least amount of endplay, the felt washers are lightly compressed against the end faces of the bracket, making a tight seal. After a year's use, the bearing shows no signs of dust cutting or abnormal wear. The tool rest is simply a piece of cold-rolled steel recessed to fit the wheel and supported on a single pillar of brass tubing through which a bolt runs into the baseboard. A tightly covered switch, placed between the motor and the wheel, completes the outfit. The tool is not suitable for heavy work, but is ideal for grinding small lathe tools and other stuff within its capacity. It can be moved to any convenient part of the bench and pushed back out of the way when it is no longer needed.—Howard Greene, Washington, D. C.

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